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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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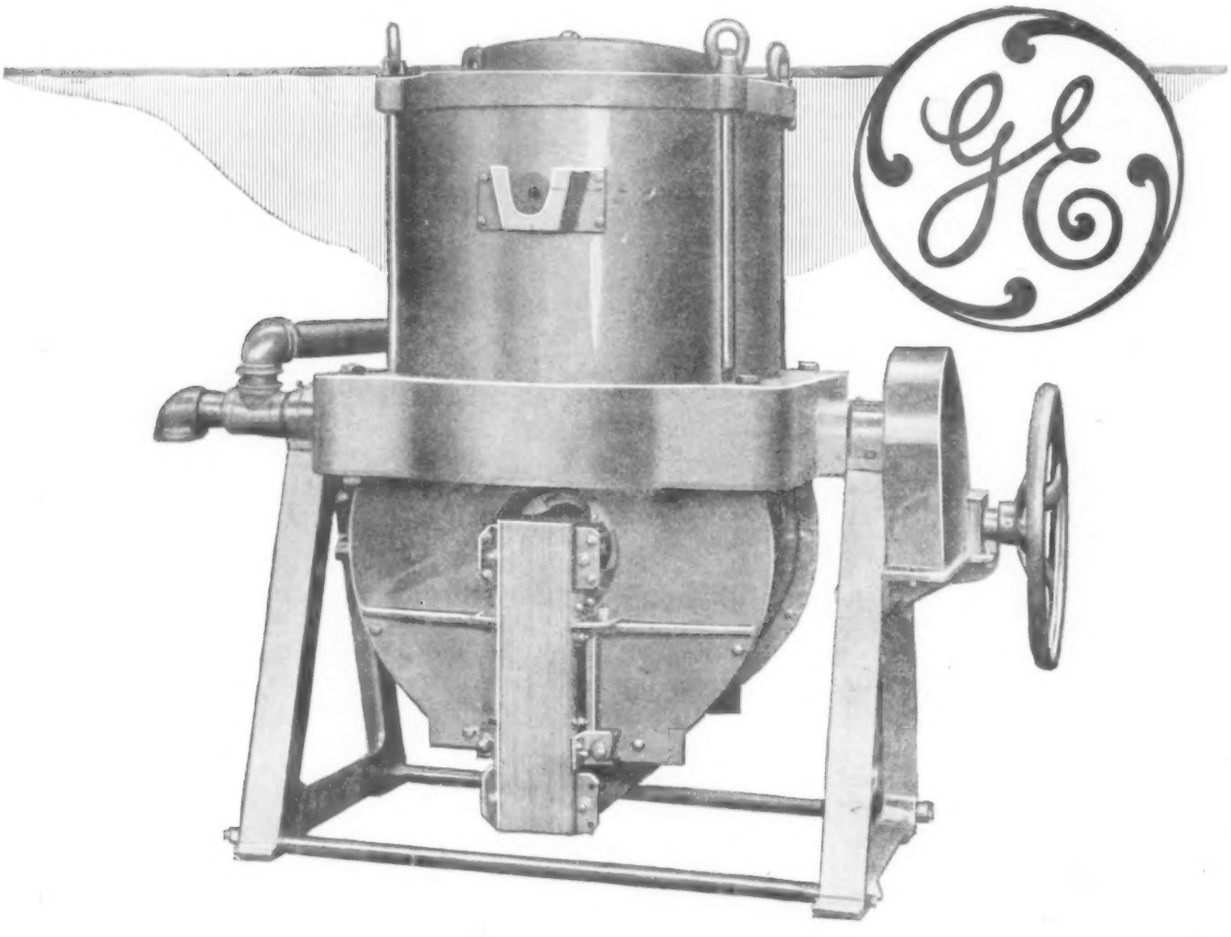
A New Electric Melting Furnace



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THE
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Vol. 21 NEW YORK, MARCH, 1923 No. 3

The Chase Metal Works

Waterbury Plant Has Interesting Advantages of Mill Construction

Written for The Metal Industry

The Chase Metal Works is a division of Chase Companies, incorporated of Waterbury, Connecticut. It operates two brass plants, the Chase Metal Works in Waterville, Connecticut, three miles away from Waterbury, and the Chase Rolling Mills in the City of Waterbury itself. These two plants cover over fifty-five acres and contain more than one and a half million square feet of floor space. They produce brass sheet, rod and wire, and brass and copper tubing of all kinds; condenser tubes and brass pipe being the specialties of the Chase Metal Works.

Many of the large brass mills of today are the result of years of haphazard growth and have developed by the addition of one building after another to the original plant. As a result the works become simply a collection of buildings not at all related to each other, especially considering the great variety of operations necessary to turn the copper and zinc into brass throughout all its different processes. In some plants for instance, the Casting Shop and Shipping Room may be side by side; one department may be far to the north and the next department far to the south, so that the flow of metal is constantly zigzagging in its path, losing time, costing money, and making transportation difficult.

TAKING A SAMPLE OF LIQUID BRASS FOR ANALYSIS

In contrast to this the Chase Metal Works were designed and built as a unit. Departments were laid out to keep the metal moving in a straight line from its first casting to its shipping. The shape of the mill, therefore, is that of a long rectangle rather than that of the usual square building. The copper, zinc and scrap are unloaded from freight cars at the northern end of the plant, there made up into charges and sent to the electric casting department, the castings moved south into the shear room where billets are sawed, flat bars sheared and rod ends clipped, and then moved south again into the various departments where they should go. In this way the metal flows along naturally and is turned out at the southern end of the plant in the finished sheet brass, tubing, rod or wire to the Shipping Departments whose long platforms permit the loading and unloading of many railroad cars at once.

SHEET BRASS

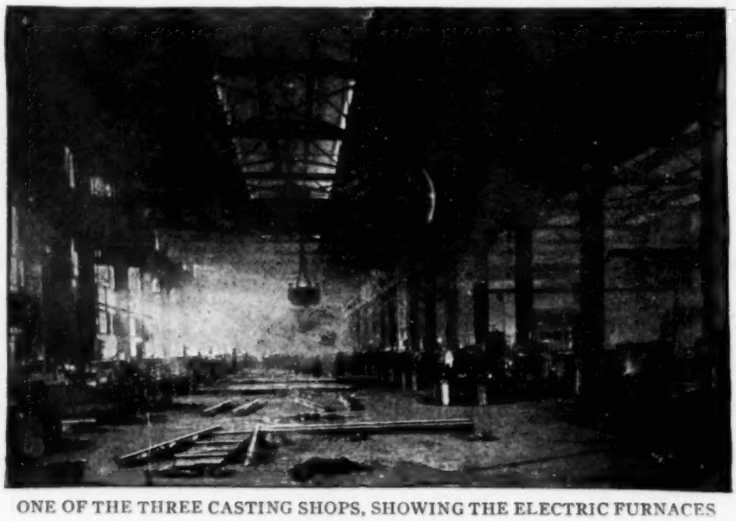
The manufacture of sheet brass is carried on at both plants, the Chase Metal Works and the Chase Rolling Mill. The liquid brass is poured into chilled iron molds of special design from electric furnaces. These molds are constructed so that they can be easily moved, cleaned and replaced with molds of other sizes. This unusually flexible arrangement makes it possible to switch a furnace from one type of work to another with a minimum of delay.

From the molds the metal is taken to the shears, the gates cut off, and then sent to the sheet mill to be rolled down into the required width and gauge. From the rolls the coils of sheet are sent to the Slitting Department where the edges are slit, truning out the sheet to the exact width required, ranging anywhere from less that ½" to 12" or more.

EXTRUDED ROD

Rods are usually cast in the form of long, heavy billets. These billets are cut to length, re-heated and sent to the extrusion press where they are compressed by hydraulic pressure against steel dies which allow the red-hot metal to flow through holes extruding one or more rods at a time. These rods are extruded at varying speeds depending on the size and shape of the rod. They are allowed

to cool, then usually coiled and drawn down in the Rod Mill to the required size. It is necessary, of course, to anneal, or heat-treat the metal after it has been cold-worked to a certain extent to relieve the internal stresses of the brass. After annealing the coils are cleaned in a solution of oil of vitriol, called "pickle" and rinsed off in hot water. It is necessary to check up these operations by inspection and micrometer after practically every operation to be sure the metal is uniform and running to gauge; also to eliminate any defective rods or scratched metal. The Wire Mill is, of course, further down the plant and there a great quantity of brass wire is turned out, pin wire being one of the specialties of the Company. Practically the same processes are carried out in the manufacture of wire as in rod.



ONE OF THE THREE CASTING SHOPS, SHOWING THE ELECTRIC FURNACES

TUBE MANUFACTURE

Tubes are cast in both the main electric Casting Shop and in a smaller one at the extreme northern part of the mill. Brass, being an alloy composed of copper and zinc, is variable and needs constant attention and inspection to insure uniformity of mixture. Impure copper or zinc can readily spoil the alloy and ruin the tubing, and it is of great importance to see that all metal is carefully analyzed for purity before being used. The copper and zinc are, therefore, checked by the laboratories before being used, and are then weighed out into charges for the electric furnaces. These charges are double-checked for correctness or weight and alloy, and sent to the Casting Shop where they are placed in the electric furnaces, the most modern development of present day casting.

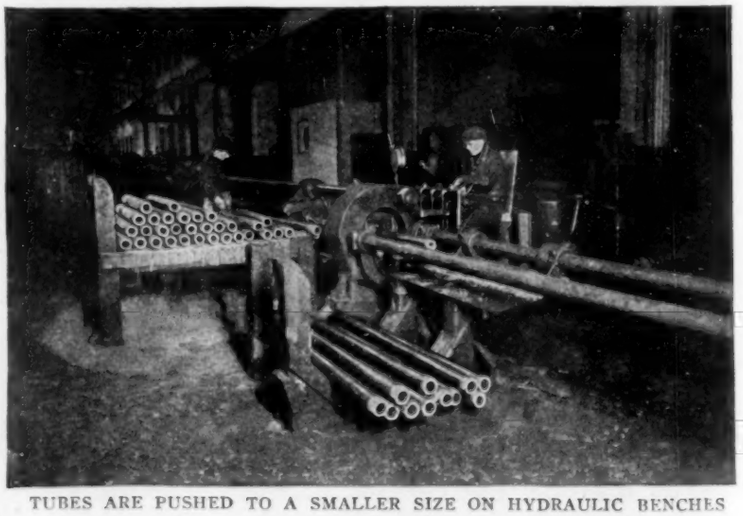
To cast brass shells a clay core is placed in the center of the iron mold, around which the liquid brass is poured. The construction of this core is extremely interesting. A perforated iron pipe is tightly wrapped with special tough fibre which holds the first layer of finely ground clay and other materials that is rolled upon it. Two or three coats of this clay are put on and then dressings of various kinds painted on to insure smoothness. The whole core is then baked for two days in ovens, the temperature of which is under accurate control. The core is then taken from the oven, coated with a special oil and placed in the mold. A porous clay core has the advantage of permitting the gases generated by the molten metal to penetrate it and pass through the holes into the perforated iron pipe, thus escaping. This helps to eliminate blow-holes or spills in the casting itself. After the metal has been cast, the perforated iron pipe in the center of the core is pulled out, and the clay, dried and partly pulverized by the heat of the melted metal is more easily removed by suitable cleaners. Samples are taken of the molten metal and also of the cast tube for analysis and for physical testing.

The pouring temperature and speed must be correct or the tubing will be defective.

From the Casting Shop, the shells are taken to the tube mill where one end is given a slight point. Then they are sent to the draw benches where they are pushed and drawn by hydraulic and chain benches through dies reducing the tube to the required size.

It is necessary to anneal the tube at intervals in order to reduce the strain caused by drawing. Each anneal is followed by pickling and washing so that the tube may be clean before the next draw, otherwise the surface of the die will be clogged with dirt and scratch the tube in the drawing process.

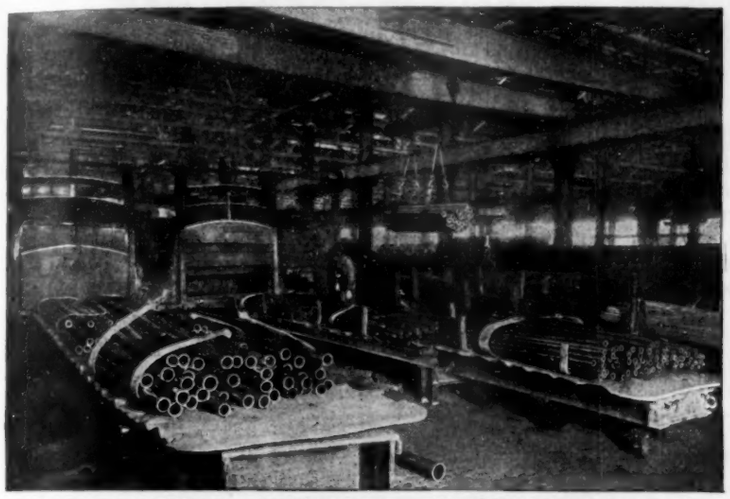
After the tube has gone through the manufacturing process, it must be thoroughly tested and checked before it can be shipped. It is cut to required lengths, depending upon the order, and samples are taken for analysis and other laboratory inspection. The tubes are moved to the inspection department where they are gone over thoroughly and every inch of the outside surface is carefully examined. The inside surfaces are also examined by the aid of electric lights shining through the tubes which show up any imperfections in a remarkable way. Providing the tube passes all these tests, it is then ready for shipment as soon as it has been approved by the laboratory. The laboratory tests are necessary to see that the tubes measure up to specifications laid down by the purchasers. Condenser tubes play a very important part in power plants and ships, hence, it is necessary that they be thoroughly tested before going into service.



TUBES ARE PUSHED TO A SMALLER SIZE ON HYDRAULIC BENCHES

At the present time, there is much controversy concerning the specifications for condenser tubes. Some claim that the tubes should be made by certain processes; others that they must have certain microstructure and physical properties. There is considerable discussion going on at the present time as to whether or not the grain size has any effect on the power of the tube to resist cor-

rosion. The subject is an extensive one, and much too long to discuss here. The Chase Metal Works, however, recommend that among the changes in the specifications for condenser tubing, should be the addition of mercurous nitrate immersion test and the decrease in the minimum tin content from 1 per cent to .9 per cent. They also recommend the optional substitution of a grain size requirement in place of the compression test and that a maximum grain size of .036 mm. is the best.



TUBES ARE ANNEALED PERIODICALLY TO REMOVE DRAWING STRAINS

Various other types of tubes are made such as brazed tubing, copper tubing, tinned tubing, etc. The brazed tubes are made by bending together the edges of sheet brass until they meet, forming a tube, then laying brazing solder in paste form along the crack between the two edges, and then passing the tubes through the furnace which melts the solder and forms a closed joint. A separate building is devoted to the tinning of tubes, and copper tubing such as water heater tubing is one of the specialties of the mill.

An interesting part of the arrangement which saves extra handling is the disposition of the stock. The machines are arranged in straight lines down the plant, and the stock is kept alongside of its machine after it has been finished. Directly alongside the stock piles is the shipping platform.

Because of the number of draws necessary to reduce a casting to a finished tube, many benches must be provided for the modern tube mill. These benches are both hydraulic and chain of various capacities and lengths.

The Inspection Department is entirely separate from the Tube Mill and its inspectors are under their own foreman. This keeps the standards of the Inspection Department high and unaffected by the natural desire of the production men to turn out the maximum quantity.

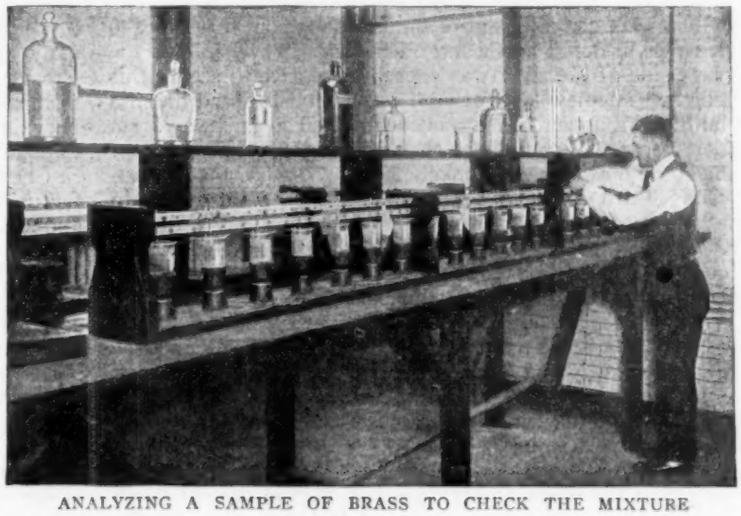
OTHER FEATURES OF THE PLANT

At the Chase Metal Works are centered thoroughly equipped laboratories for chemical analysis, physical testing and research work. Here are maintained a competent staff of chemists and metallurgists to check the analysis and quality of their metal, and to keep it up to its standard.

The Power Plant which takes care of the Chase Metal Works is supplemented by a current from the local power company which can be used in case of emergency. The boilers are fed by automatic stokers and the steam operates turbines connected directly onto the generators, alternating current being used. The condenser water is used to heat over 36 acres of floor space by an ingenious process, the first of its kind the Company believes to be installed in America. It is done by connecting over 78 miles of pipe directly on to the condensers in the power house, and by pumping hot water through the mill, returning it back to the condenser again, re-heating it and sending it on, in this endless chain, through the mill and back. One of these condensers gives over 178,792 feet of radiation, calling for 3,000 gallons of circulating water per minute, giving the mill a temperature of 56 degrees and the office 68 degrees. Large storage facilities have been provided for housing over 10,000 tons of coal, and the Company has a storage capacity for about a half a million gallons of oil, of which it uses a great deal in its annealing furnaces.

The latest and a most interesting addition to the plant is the Waterville Machine Works, a beautifully equipped machine shop of the most modern type. It is housed in a building entirely separate from the mill, and makes many machines for others as well as for the Chase Companies' plants and does most of the heavy repair work for the Chase Metal Works and the Chase Rolling Mills. The electric furnaces of the Ajax-Wyatt type are manufactured here by the Chase Metal Works under special agreement with the Ajax Company, and the plant also turns out metal working machinery such as rolls and draw benches, and makes many specialized products. It is equipped to handle machine work of almost any size from the casting to the finished product. A large tunnel connects the Waterville Machine Shop with the Chase Metal Works' buildings so that there is no possibility of weather conditions interfering with the quick and sure transportation of needed supplies and machinery, and all pipes, transmission lines, etc., are run through this tunnel.

An electric trolley line connects the Chase Rolling Mill with the Chase Metal Works and this, in addition to the spur track of the New Haven Railroad which runs directly up to the shipping platform. furnishes easy transportation.



ANALYZING A SAMPLE OF BRASS TO CHECK THE MIXTURE

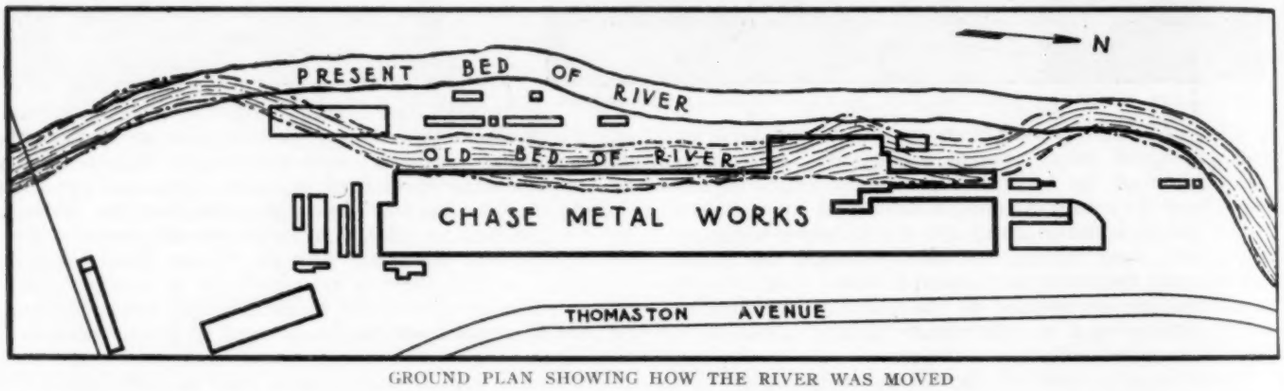
The brass itself is moved around the plant by electric and gasoline trucks and overhead cranes, and the Company has its own engine and freight cars for plant and construction work.

The Chase Metal Works includes a box making plant, a department for repairing and rebuilding electric and other trucks, a Fire Department, restaurant which furnishes meals for between 800 and 900 men a day at actual cost, a dairy, a baking plant, a store for candy, fruit, etc., and the hospital with its attendant nurse.

It has been in existence about twelve years. In spite of being a very extensive plant it has been laid out almost as if it were to have been built at once. It has the advantages, and the economies that come with the most permanent construction of properly designed and uniform types of buildings which permit consistent and logical increase according to prearranged plans in harmony with existing buildings.

MOVING THE RIVER

Years ago, when the Chase Rolling Mill began to develop, it was evident that another mill must be built to take care of the increased demand for brass in its raw form. A large level site, containing about 25 acres was finally chosen, just above the town of Waterville, and about three miles from Waterbury. This land, being low, was flooded by the waters of the Naugatuck River at freshet times but was level and convenient for manufacture. Flood levels were investigated and a level of three feet higher than the highest known water mark was established as a floor level for any mill buildings to be erected. This meant the filling in of the lowland from three feet to ten feet in depth and a large sand and gravel hill on the west side of the river was chosen as a place to secure this filling. The new level of land was established and the mill built and a power house was constructed so far away from the rest of the buildings that, although future development of the Mill was looked for, there were many criticisms heard about it being so far away from the main plant.



GROUND PLAN SHOWING HOW THE RIVER WAS MOVED

At the present time, this power house is in the direct center of the Mill, as the mill buildings have not only been built up to it, but as far again beyond it.

The Chase Metal Works at this time lay on a flat strip of land, bordered on one side by the Railroad and the State Highway and on the other by the Naugatuck River. After the war broke out, more land was needed for still further building and it became a question where new buildings were to be built.

John Hard made the suggestion, "Why not change the course of the River and build a new Mill in the old River bed?" Plans were drawn up and Robt. A. Cairnes, the City Engineer of Waterbury, was secured as Consulting Engineer. In the summer of 1914, a meeting was held in F. S. Chase's office. H. S. Chase, F. S. Chase, R. A. Cairnes and Arthur Greene talked over John Hard's suggestion to move the Naugatuck River to a new location and the following order was issued to proceed with the work:—

"Mr. J. O'Brien:—

Please change the location of the Naugatuck River, as per enclosed blue prints."

When the work was finished and a survey made of what had been accomplished, it was found that a channel 100 feet wide at the bottom with a bank taking a 1½% to 2% slope had been dug for more than 1½ miles, that over 100,000 cubic yards of rock blasted and moved, 400,000 cubic yards of gravel and soil changed to a new location, over 40 acres of land re-claimed, over 26 acres of concrete and steel buildings constructed, ½ mile 36" intake water pipe laid, miles of 24" and smaller tile pipe laid, two steel bridges constructed across the river, a small dam placed across to divert the water for manufacturing purposes.

HISTORY OF THE COMPANY

The Chase Metal Works is a division of Chase Companies, Incorporated, which controls among other plants the Waterbury Manufacturing Company, the mother institution of the Company.

The Waterbury Manufacturing Company was founded in 1837. It was originally called "Hitchcocks," and later became known as the United States Button Company, and made buttons and similar novelties of steel, bone and brass.

This concern passed into control of A. S. Chase, who was at that time the President of the Waterbury National Bank, Waterbury Buckle Company, Smith & Griggs Manufacturing Company, Holmes, Booth & Hayden Company and other manufacturing interests. He was later President of the Benedict & Burnham Manufacturing Company, at that time the largest brass concern in Waterbury before it became a branch of the American Brass Company, and also the Waterbury Watch Company. A. S. Chase was the first President of the Waterbury Manufacturing Company, and with his son, Henry S. Chase, and Charles F. Pope began the business which is now known as the Chase Companies, Incorporated.

In 1884 Pope moved to New York, his interest being bought out by A. S. Chase and Henry S. Chase on a basis of equal ownership. Under Henry S. Chase's management, and that of his close friend and associate, the late Richard J. Ashworth, the Waterbury Manufacturing Company grew from an almost insignificant beginning into one of the largest consumers of brass in the United States. By 1900, four years after the death of A. S. Chase, the growth of the business warranted the building of the Chase Rolling Mills, principally to manufacture the brass needed by the Waterbury Manufacturing Company and other concerns in which the family was interested. Anticipating the future of the brass business, extensive tracts of land were purchased in Waterville to meet the possibilities of further expansion, and by 1911 the Chase Metal Works had been started.

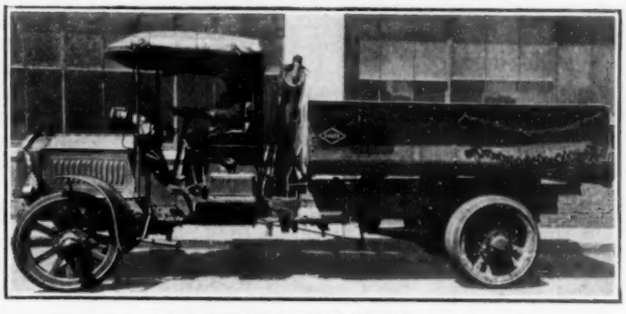
The Waterbury Manufacturing Company and the Chase Rolling Mills Company were finally merged

in the Chase Companies, Incorporated, a monument to the business ability and success of Henry S. Chase fortified by the close co-operation and wise counsel of his brother and successor as President, Frederick S. Chase.

The capital stock of the Waterbury Manufacturing Company was $2,000,000 and that of the Chase Rolling Mill Company also $2,000,000. In 1917 The Chase Metal Works, Incorporated, with a capital stock of $4,000,000, changed its name to The Chase Companies, Incorporated, and later in the same year acquired all the property and indebtedness of the Waterbury Manufacturing Company and also of the Chase Rolling Mill Company, which were thereupon dissolved. The capital stock of The Chase Companies, Incorporated, remained $4,000,000 until December, 1922, when it was increased to $10,000,000.

CHASE COMPANIES OFFICE, WATERBURY, CONN.

HAULING BY HORSES IN 1900



TRUCKING BY MOTOR IN 1920

A List of Alloys

Reprinted from the Booklet Published by the American Society for Testing Materials. Part 1*

By WILLIAM CAMPBELL†

In order to show the difficulties which are met with when an attempt is made to formulate a logical and scientific classification of alloys, the following list of alloys has been compiled.

The subject of nomenclature is one of some difficulty. Brass has been defined as an alloy of copper with zinc as the principal alloying metal, whereas bronze is a copper alloy in which tin is the chief added element, and yet it is the custom to call red brass by the name of "bronze." Again. Tobin "bronze," manganese "bronze," etc., are properly speaking, brasses.

While this list is primarily one of non-ferrous alloys, there have been added a few examples of what are, properly speaking, iron alloys (in contra-distinction to steel) in which the properties are dependent on the added elements, as, for example, in the list of non-corrosive alloys and of the heat-resisting alloys as well as those used for resistance purposes.

It often happens that when a new alloy is brought out its composition is apparently new, but on referring to some of the older books on metals and alloys we find it mentioned under another name. Numerous alloys can be found in such works as Bischoff (1865), Berlin; Bolley (1869), Paris; Guettier (Fesquet); Thurston (Part 3); Law's Alloys; R. A. Wood's "The Waterbury Book of Alloys," etc.

In 1911 Kaiser published a very complete list of metals and alloys in Metallurgie (1911), Vol. VIII, pp. 257, 296.

In 1918, the Metal Industry of London published a small booklet entitled "Metals and Alloys" which covered Kaiser's list with some few additions.

While both of these lists are useful in that they are arranged alphabetically, for our purpose an arrangement by groups is better in that it shows the wide variations in composition in many of our commercial alloys. In the accompanying list, therefore, this method has been followed, using Kaiser's list as a basis and adding to it such other alloys as have been found in the literature or met with in practice.

The list will be printed serially, beginning with our April issue.—Ed.

*This booklet can be obtained from THE METAL INDUSTRY for $1.

†Professor of Metallurgy, School of Mines, Columbia University.

Aluminum Bronze Unfit for Bearings

Q. Is aluminum bronze suitable for bearings?

A. While I think aluminum bronze is one of the best made in the non-ferrous field when properly handled, I can not see aluminum bronze for a bearing metal. It has been tried on railroad work and failed.

The metal generally used for rolling mill work in brass rolling mills is as follows:

74—Copper, 16—Lead, 7—Tin, 2—15% Phosphor Copper.

The metal used in steel rolling mills is as follows:

55.25—Copper, 44.61—Lead, .41—Tin.

W. J. REARDON.

Meeting of the Institute of Metals Division

A Report of the Sessions Held in New York, February 19-21, 1923

The New York meeting of the Institute of Metals Division of the American Institute of Mining and Metallurgical engineers was held at the Engineering Building, 29 West Thirty-ninth street, February 19-21, 1923.

The nominating committee reported the renomination of all the present officers, who are as follows:

Chairman—W. B. Price.

Vice-Chairman—G. K. Elliott.

Secretary-Treasurer—W. M. Corse.

Executive Committee—C. T. Bragg, H. M. Lane, Dr. William Campbell, J. A. Capp, L. Addicks, G. F. Comstock, E. E. Thum, W. A. Cowan and H. M. Williams.

SOLID SOLUTIONS

BY WALTER ROSENHAIN

On Monday, February 19, Dr. Walter Rosenhain delivered a lecture on solid solutions. He began by defining that term and then describing the various ways in which alloys solidify, and the manner in which solid solutions are formed, pointing out that essentially all the constituents of alloys are solid solutions.

He then explained in considerable detail how solid solutions were formed and showed how the use of X-rays had clarified this phenomenon. Due to the work done along these lines, the theory of "substitution" has been adopted as the most likely explanation to account for the solution of one metal in another; in other words, that the "stranger" atom takes the place of one of the atoms of the solvent metal. This, of course, results in the distortion of the original crystal and consequent hardening by the disturbance of the smooth gliding surface along which plastic deformation formerly took place. Dr. Rosenhain pointed out that this theory accounted for the depression of the freezing point and widening of the freezing range in the case of solid solutions; also that it explained the mechanism by which diffusion can occur in a solid crystal.

In summing up his conclusions the lecturer pointed out that if his inference were completely supported by fact, when further observations had been obtained, the considerations put forward might well be recorded as forming a general theory of the inner structure of solid solutions and of alloys. Ultimately, it might be hoped that the whole of the properties of alloy systems could then be calculated from the knowledge of the atomic constants of their constituents.

NATURE OF SOLID SOLUTIONS

BY E. C. BAIN*

An explanation was given of the constitution of solid solutions in general, very much along the lines of the lecture by Dr. Rosenhain, delivered the previous day. The author showed the atomic structure of a number of binary alloys.

CORED CRYSTALS AND METALLIC COMPOUNDS

BY E. C. BAIN*

The author explained that each dendrite holds in it a number of minute crystals, which have lattices like each other, but with slightly different sizes and compositions. The intermetallic materials are brittle because of their complicated lattices, which permit little slip.

*General Electric Company, Cleveland, O.

The papers were discussed at considerable length by Messrs. **St. John, Bain, Alexander, Jeffries** and **Rosenhain.**

POLISHING ALUMINUM AND ITS ALLOYS FOR METALLOGRAPHIC STUDY

BY E. H. DIX, JR.†

Recently it has been found possible to obtain a polished surface practically free from scratches and in which the hard constituents stand out in slight relief and in varying colors, so that in few exceptions they can be identified without etching. The paper consisted of a brief description of the methods used for this purpose in the metallurgical laboratory of the Engineering Division of the U. S. Army Air Service, the Cook Field. A number of extraordinarily fine photomicrographs were shown.

OBSERVATIONS ON THE OCCURRENCE OF IRON AND SILICON IN ALUMINUM

BY E. H. DIX, JR.†

This paper illustrated in detail the various structures found in commercial aluminum containing the usual iron and silicon impurities. The characteristic form of the $FeAl_3$-aluminum eutectic, of the silicon-aluminum eutectic, and of the ternary eutectic of silicon, constituent X, and aluminum, were shown by a series of photomicrographs. It was further shown that the constituent X often takes the same form as $FeAl_3$, and cannot be distinguished except by careful examination. A method of etching to aid in differentiating between these two constituents was cited.

Both the above papers were read for **Mr. Dix,** who could not attend the meetings by **E. E. Thum. R. J. Anderson** commented that the photomicrographs showed unusual care and patience.

Dr. Rosenhain corrected a statement about the early use of magnesia as a polishing medium, pointing out that he had used it as far back as 1906. He admitted that the Fe-Si-Al system had not yet been completely worked out, and asked if the X-ray specialists could throw any light on it.

In response to a question about the care of magnesia he stated that it must be kept clean and dry, and bought from a reliable source. The pad on which it was used must be kept wet, and scrubbed with a special brush and distilled water after using.

THERMAL PROPERTIES OF ALUMINUM SILICON ALLOYS

BY JUNIUS D. EDWARDS††

The author explained the experimental methods used in determining the densities of aluminum alloys with varying quantities of silicon. Results were given up to 1,000° C. for crystallization shrinkage, total solid shrinkage and piping.

E. E. Thum asked for the reason for the modifications and different equilibrium diagrams of the same mixtures made under different processes. **Zay Jeffries** answered that it was surmised that it was caused by the interference of the natural growth silicon crystals by foreign materials present. Sodium, for example, on cool-

†Chief, Metals Branch, Engineering Division, Air Service, McCook Field, Ohio.

††Assistant Director of Research, Aluminum Company of America.

ing, precipitates many small, even colloidal, globules, which get in the way of the silicon atoms and do not allow the free growth of these silicon crystals. This causes undercooling, which increases the speed of solidification.

PRACTICAL SPECTOGRAPHIC ANALYSIS

BY W. F. MEGZERS, C. C. KIESS AND F. J. STIMSON*

A brief review of various methods which have been proposed for chemical analyses by means of the spectrum is followed by a detailed description of the principles, apparatus, and procedure employed in making quantitative analyses from the spectra of condensed sparks. The practical application of this method is illustrated by three examples taken from the work of the spectroscopy section of the Bureau of Standards and deals with the quantitative determination of impurities in various samples of tin, gold, and platinum. Other applications to problems in chemistry, metallurgy, mineralogy, physics, biology, etc., are suggested.

WEDNESDAY, FEBRUARY 21, SESSION

OCCURRENCE, CHEMISTRY, AND USES OF SELENIUM AND TELLURIUM

BY VICTOR LENHER†

After introductory remarks on the occurrence of selenium and tellurium in nature, and the sources from which they are actually derived, the paper describes first the chemical relationship of the elements, and next the usual methods for their qualitative detection. The most exhaustive section of the paper relates to the quantitative determination of the two elements, whether singly or in conjunction, or in combination with various other elements. A number of tested analytical methods are described in detail. The concluding section of the paper mentions the uses of the two elements with suggestions for increasing their fields of usefulness.

This paper was read, in the absence of the author by **S. Skowronski,** who stated that it was the most complete compilation in print of all published material on selenium and tellurium. Selenium is now being used in large quantities in the glass industry to replace manganese dioxide, as a decolorizer. The uses for tellurium are still small.

D. M. Liddell presented a written discussion which added a number of items and elaborated others.

In answer to a question, **Mr. Skowronski** stated that selenium could not be electro-deposited, but tellurium could be deposited very easily, in sulphate solution. As a material for this purpose, however, its characteristics were that it was very hard and brittle, and formed tellurides with other metals when in contact.

DETERMINATION OF GASES IN METALS

BY HAROLD LESTER SIMONS

The paper described the method used in the laboratory of the Magna Metal Corporation, of Newark, N. J. In the absence of the author, the paper was accepted by title.

A STUDY OF BEARING METALS

BY CHRISTOPHER H. BIERBAUM‡

Bearing metals must be composed of an intimate mixture of soft and hard crystals, using the term hard to express the capacity for resisting cutting or abrasion. It is now appreciated that the physical properties of the journal bear some relation to the bearing metal, as for best service the bearing and journal must polish each other. Therefore, the hardest crystal in the bearing metal must bear some relation to the hardest crystal in the journal. The relative hardness of these individual crystals has not been studied heretofore, and it is with this object in view that the instrument herein described was developed. Its idea was suggested by the fact, sometimes observed upon a polished metallographic specimen, that a continuous sharp cut, crossing several crystals, is wider on some than [illegible]s.

The following fundamental requirements were established: (1) The cutting point must be ground with an extreme precision and to definite specifications; its shape must be such that the vertical pressure exerted upon the surface tested will be greater at all times than the horizontal pull applied to the point. (2) The cutting point must be so mounted that it can respond to vertical motion with the minimum inertia, and it must exert a constant pressure while passing over the test surface. (3) The cutting point must be moved over the test surface at a uniform rate, so that no additional indentation may occur by stopping on the softest crystal.

Of the numerous hard materials investigated, the artificial leuco-sapphire (fused Al_2O_3) has proved extremely satisfactory, in that it has the necessary homogeneity, and is much harder than any crystals in ordinary metals, including martensite and fused tin oxide, the latter being the hardest crystal so far encountered in any alloys or their impurities. The form of point that was finally adopted was the corner of a cube. The jewel was cylindrical in form, 0.022 in. diameter and 0.08 in. long. It is mounted so that the diagonal of the cube is normal to the surface to be tested and one edge faces the direction of motion.

The paper described in detail the construction of the testing device and the manner of using it. The width of the scratch is measured, by micrometer eyepiece, in microns—λ or 0.001 mm.—from which the "micro-hardness" is computed by the formula, $\kappa = 10^4\ \lambda^{-2}$. A curve is given for quick conversion of micrometer readings into microhardness. The paper was illustrated by photographs of microcuts on various metals and alloys, and presents a table giving the microhardness of several pure metals and alloy crystals.

By the use of this instrument, it has been shown clearly that the addition of over 2 per cent of zinc to a copper-tin bronze increases the hardness of those crystals which, without the zinc, would have been the softest. The addition of zinc, therefore, tends to reduce the range of hardness between the hardest and the softest crystals and thereby diminishes the usefulness of such an alloy for bearings, a fact which has long been known in practice.

H. S. Randon, in the discussion, gave a history of the development of hardness testing. **E. H. Dix, Jr.,** in a note read by **P. E. Demmler,** asked if it was possible to determine accurately the variations in hardness of cored crystals. Mr. Bierbaum answered that it was easy to do, if the instrument was properly adjusted.

TESTS ON HIGH TIN BEARING METALS

BY P. W. PRIESTLY

The paper covered the properties (microscopical, chemical and physical) of these anti-friction metals; also the casting practice and thermal treatment. Mechanical tests of a number of alloys were tabulated covering hardness, compressive strength and co-efficient of friction. The paper was read by **C. H. Bierbaum** in the absence of the author.

*Physicist, Associate Physicist and Assistant Physicist, Bureau of Standards, Washington, D. C.
†Prof. Chemistry, Univ. of Wisconsin, Madison, Wis.
‡Consulting Engineer, Buffalo, N. Y.

BRIGHT ANNEALING OF COPPER WIRE IN AN ATMOSPHERE OF NATURAL GAS

BY P. E. DEMMLER*

The apparatus used in the process of bright annealing of copper wire consisted of a section of iron pipe, 6 ft. long and 3 in. in diameter, provided with flanges to which were bolted end plates for sealing, also with inlet and outlet tubes to permit displacement of the air by natural gas. After charging with copper wire on spools, sealing, and displacing the air, the pipe was heated to 350° C. Mr. Demmler supposed that the natural gas would furnish a neutral atmosphere which would prevent oxidation and give a satisfactory bright-annealed product. It was found, however, that the outer layers of wire were discolored.

Skeins of the hard-drawn wire were placed in a glass tube and heated to different temperatures under varying conditions. The temperature in each case was determined by a thermocouple. Following is a summary of the results of these experiments:

1. When the wire was heated for 1 hr. in a current of natural gas, at a temperature of 350°, 400°, or 500° C., there was a marked darkening of the wire throughout the skein.
2. When heated for 1 hr. in natural gas at a temperature of 600° C. there was no coloration.
3. When heated in natural gas to 350° C. until darkened and the treatment continued at a temperature of 600° C., the coloration disappeared.
4. When heated to 350° C. in natural gas that had been passed over copper heated to 600° C. before entering the annealing chamber, no coloration was produced.
5. When heated in air to 350° C. for 15 min., a heavy scale of oxide was produced. On displacing the air by natural gas and then heating to 600° C., the dark color disappeared.

The discoloring of the copper wire was evidently oxidation caused by a small amount of oxygen in the natural gas, the presence of which was demonstrated by alkaline pyrogallate solution. Similar trouble might arise in the use of coal gas and other manufactured gases for this purpose.

The experiments demonstrate that satisfactory bright annealing of copper wire in natural gas containing small amounts of oxygen is possible by two procedures: (1) Heat the wire to 600° C.; or (2) pass the gas over copper heated to 600° C. before admitting it to the chamber containing the wire to be annealed, which is heated to 350° C.

Practical considerations indicate that the second method is preferable. There is a considerable saving in heating the large annealing chamber to 350° rather than to 600° C. Furthermore, it is not practical to anneal wire on spools at 600° C., as at this temperature the expansion causes the wire to weld so that it may become impossible to unwind it from the spools. The small amount of copper wire necessary for treating the gas in the preheating furnace lasts indefinitely, as the action is catalytic, copper oxide being immediately reduced, at 600° C., by the hydrocarbons present in the gas. No change in either the annealing oven or the process is necessary, the apparatus for heating and deoxidizing the gas being installed outside the oven.

O. Lellep stated that he had had some interesting experiences in annealing copper in reducing atmospheres.

In a plant in which he had been engaged it was decided that since the typical installation for bright annealing was so expensive, some work would be done to see if it could not be simplified. It was found that the products of combustion of city gas left the copper bright, as a general thing. However, throughout these experiments, it was found that some of the copper turned black. No oxygen was discoverable in the atmosphere in which the copper had been annealed, and it was determined by means of such a delicate indicator as a bright copper wire in the flame, that the burner flame was also reducing in character. Nevertheless, in spite of these facts, some of the material insisted coming out dark.

It was found later that this was due to carbon which had resulted from the decomposition of carbon monoxide at elevated temperatures.

$$2\,CO = CO_2 + C$$

This reaction had occurred catalytically in the presence of copper. However, raising the temperature to 600° or 650° C. reversed this reaction. **Mr. Lellep** suggested that the dark coating found by **Mr. Demmler** might be due to carbon.

T. S. Fuller pointed out the danger of embrittlement of the copper if even a little oxygen was present in the atmosphere.

Mr. Demmler stated that so far as they had been able to discover, there was no evidence of carbon on the metal. Nor had any difficulty been experienced with embrittlement at the temperature of 350° C.

*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

THERMAL CONDUCTIVITY OF SOME INDUSTRIAL ALLOYS

BY H. M. WILLIAMS AND V. W. BIHLMAN†

This paper described a convenient apparatus for the determination of thermal conductivity of metals with an accuracy within 2 per cent. The thermal conductivities of a number of commercial alloys, as determined with this appartus, were given.

The paper was read, in the absence of its authors, by **J. R. Freeman, Jr.**

†Chief Metallurgist and Physicist, respectively, General Motors Research Corporation, Dayton, Ohio.

Soldering Cast Iron

Q.—We desire to know the composition of same, flux to be used and if in your mind there is a substantial cast iron solder on the market.

A.—The flux to use for soldering iron is chloride of zinc. To solder cast iron first copperize the cast iron surface to be soldered with blue vitriol. It is necessary that the cast iron surface be thoroughly cleaned and polished before the blue vitriol is put onto it. After having applied the blue vitriol allow the surface to dry thoroughly and then solder on the copperized surface the same as in ordinary soldering, using an alloy composed of 50% tin, 50% lead.

A small percentage of phosphorus renders soft solder very lively, that is, the solder has a tendency to run freely. Too much phosphorus is injurious but if it is used, it should be in the form of phospher-tin; one or two ounces of five per cent phosphor-tin to one hundred pounds of solder is sufficient.

Hard soldering of iron is generally known as brazing and the solder as spelter. For hard soldering or brazing, a red heat is necessary and borax is used as a flux to protect the metal from oxidation and to dissolve the oxides formed. Heating cannot be done with a soldering iron but should be effected by a blow pipe, blow torch or gas forge. The chief advantage of a brazed joint, however, lies in its great strength. A greater degree of heat is required to melt spelter than soft solder and the chief advantage of a brazed joint on cast iron lies in its superior strength compared to soft solder.—P. W. BLAIR.

American Foundrymen's Association

Convention Announcements

By C. E. HOYT, Secretary

The Twenty-seventh Annual Convention of the American Foundrymen's Association will convene in Cleveland, Ohio, Monday, April 30th, continuing through Thursday, May 3rd. Registration, Headquarters, and Exhibits will all be located in the Cleveland Auditorium on Sixth Street.

All technical meetings of the American Foundrymen's Association and the Metals Division will be held at The Hollenden Hotel, Sixth and Superior Streets, just two blocks from the Auditorium.

EXHIBIT DATES

Attention is called to the fact that the Exhibits will open on Saturday, April 28th, remaining open until 10:00 P. M. Saturday evening, will be closed on Sunday, and open from 9:00 A. M. until 5:00 P. M., Monday, Tuesday, Wednesday and Thursday. Saturday will be known as Cleveland Day for inspection of Exhibits.

ENTERTAINMENT

Attractive entertainment will be provided for members and ladies in attendance. On Tuesday evening, May 1st, foundrymen's get together and good fellowship meeting will be staged. High class entertainment is assured and every foundryman present at the Convention will want to attend.

On Wednesday evening, May 2nd, the Annual Subscription Banquet will be held. The banquet committee promises speakers of national reputation. This is an event which foundrymen should not miss and to which the ladies are invited. A detailed announcement of the entertainment program will be made later.

TECHNICAL PROGRAM FOR CLEVELAND CONVENTION

The tentative schedule for the technical sessions is given below:

SATURDAY, APRIL 28

Opening of Exhibits and Registration.

MONDAY, APRIL 30

A. M. Registration.

1:30 P. M. (a) Non-Ferrous Session, Aluminum Foundry Topics.
(b) Steel Foundry Session.
(c) Gray Iron Foundry Session.

TUESDAY, MAY 1

9:00 A. M. (a) Industrial Relations.
Symposium on Training Foundry Workers.
(b) Non-Ferrous Session, Brass Foundry Topics.
Joint Session of A. F. A. and A. I. M. E.
(c) Steel Foundry Session.

1:30 P. M. Sand Research Session, Testing Sands.

WEDNESDAY, MAY 2

9:00 A. M. Sand Research Session, Reclaiming Used Foundry Sands.

1:30 P. M. (a) Malleable Cast Iron Session.
(b) New Developments in the Foundry Industry.

7:00 P. M. Annual Banquet.

THURSDAY, MAY 3

9:30 A. M. Final Business Meeting.

The sessions on Molding Sand Research will be largely given over to committee reports of the joint A. F. A. and National Research Council on Foundry Sand Investigations. As this investigation has been actively conducted since the Rochester meeting, it is expected that many reports of the greatest value to all foundrymen will be brought out as the result of the work of the three subcommittees on Sand Testing, Reclamation and Conversion and on Geological Survey.

The Aluminum Foundry Session initiated at the 1922 Convention proved such a success that it is to be continued because of the rapid development and increasing importance of this branch of the industry. The training of foundry workers is to be emphasized by the committees on Industrial Education as it is felt that this important foundry problem will have to be given attention in the past few years to supply the need for trained foremen.

A partial list of technical papers which have been offered for presentation follows:

"Aluminum Casting Alloys," Robert J. Anderson, Bureau of Mines, Pittsburgh, Pa.

"Melting Aluminum Alloys in the Electric Furnace," T. F. Bailey, Electric Machine Corporation, New Rochelle, N. Y.

"Casting Aluminum Radiator Fronts," Joseph Greves, Alloy Foundry & Machine Corporation, New Rochelle, N. Y.

"British Foundry Practice, Ferrous and Non-Ferrous," Dr. Percy Longmuir, British Cast Iron Research Assn.

"Relation Between Plant Layout and Plant Cost," L. M. Hansen, Chicago.

"Comparison of Brass Melted in Open Flame, Crucible and Electric Furnace," Mr. Romanoff, Ohio Brass Company, Mansfield, Ohio.

"Casting Bronze Tablets in a Commercial Foundry," Jacob G. Kasjens, Brass Foundry Company, Peoria, Ill.

"Investigation of Core Sands," C. S. Koch, Fort Pitt Steel Casting Company, McKeesport, Pa.

"Data on Rouse of Spent Molding Sand," F. L. Wolf and A. A. Grubb, Ohio Brass Company, Mansfield, Ohio.

FRENCH INTERNATIONAL FOUNDRY CONGRESS

The American Foundrymen's Associations Committee on International Relations have sent out an announcement of a proposed trip to the French International Foundry Congress and Exposition at Paris, September 12, 13, 14, and 15, 1923. The announcement offers two itineraries for the trip over. The first one proposes leaving New York, August 18, arriving in London August 25. Seventeen days would be spent in England visiting industrial centers and places of historical interest.

Itinerary No. 2 proposes leaving New York August 25, arriving at London, September 1, with a reception to be given in the evening of that day, and then spending ten days in touring England. Whichever itinerary is chosen, the date for leaving London for Paris will be the same, Tuesday, September 11.

The official reception at the Paris Convention will be held on the afternoon of September 12, with a session in the English language on Thursday morning and banquet on Friday evening. The exposition will be held in Ecole des Art et Metiers (Arts and Trades School), and is to be open from September 6 to 14. American manufacturers of foundry equipment are invited to make exhibits. Complete information regarding exhibits can be obtained by writing to the Association Technique de Fonderie, 10 Rue de Lancry, Paris.

All arrangements for the A. F. A. party are being made by our Committee on International Relations, of which H. Cole Estep, London, England, is Chairman, and Stanley G. Flagg, Jr. of Philadelphia, Vice-Chairman. All reservation forms and requests for information should be addressed to Stanley G. Flagg, Morris Building, Philadelphia, Pa. Mr. Flagg urges prompt reply, as it is very important that arrangements be completed very soon in order that return passage may be secured.

A cordial invitation is extended to all foundrymen of the United States and Canada to join the party.

Dial Copper and 12% Watch Nickel

An Article Describing the Manufacture of These Products from the Raw Material to the Finished Product—Part 3*

By WILLIAM B. PRICE, Chief Chemist and Metallurgist, Scovill Manufacturing Company, Waterbury, Conn.

POURING TEMPERATURE

The old method of judging the pouring temperature was by means of introducing an iron stirring bar into the charge. When the zinc boils it gives a vibration to the iron bar or the so-called "kick". Experienced casters have a highly developed sense of touch. This is, however, not always infallible and the modern method of taking the temperature accurately is by means of a pyrometer. Just before the metal is ready to be poured the lead in introduced and the melt thoroughly stirred by means of an iron rod to insure a uniform mixture.

SKIMMING AND POURING

The crucible is now ready to be skimmed. The layer of charcoal and dross is removed by means of an iron skimming tool shaped like a hoe. The furnace is now tilted and the metal poured through an iron strainer into the cast iron molds.

Previous to using, the molds are coated with a mold oil, consisting of a mixture of lard and mineral oils. Coating the molds prevents molten metal from pitting the

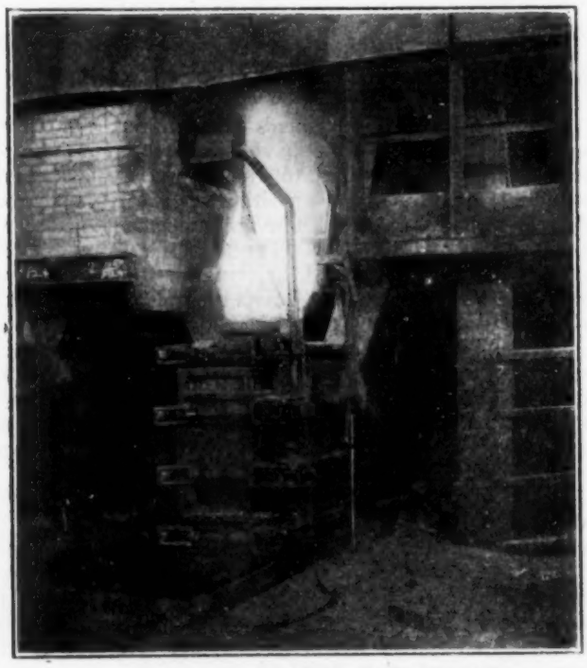


PLATE 12. POURING WATCH NICKEL

molds, and the oil burning at the top of the mold, also protects the stream of metal from oxidation by forming a reducing atmosphere. The pouring of watch nickel from the furnace into the molds is shown in Plate 12.

CUTTING OFF THE GATE

When the metal has cooled down sufficiently, the molds are opened, and the bars are taken out and carefully piled on the casting shop floor. They are then picked up by a traveling crane and taken to the alligator shears, where the gate end is cut off. The piece cut off is examined to determine whether enough has been taken off to eliminate the pipe caused by the shrinking of the bar in the mold. The cut surface is also carefully examined by the inspector, who is able to judge the quality of the metal.

If the metal is still unsound or otherwise defective, further cuts are made until good metal results. The bars are then cut in two and the different halves inspected in the same manner. This is illustrated in Plate 14.

The sound bars are then annealed in an annealing muffle in order to relieve any casting strains and render the structure homogeneous by the diffusion of the nickel throughout the crystal grains.

THE METALLOGRAPHY OF WATCH NICKEL

The microstructure of Watch Nickel is more complex than that of copper owing to the fact that we are dealing with an alloy made up of four constituents instead of one as is the case with a pure metal. The copper, nickel and zinc when in the melted condition, mix completely and dissolve into one another while the lead mixes only mechanically. When the alloy solidifies, this same condition still holds so that every crystal of material contains a mixture of nickel, copper, and zinc in solid solution while the lead is disseminated throughout the mass as free lead.

The mechanics of solidification are as follows:

Upon cooling down from the molten state, the metal begins to solidify or freeze in many places at the same time.

These centers or crystal nuclei are the starting point of the future crystals. In spite of the fact that in the molten

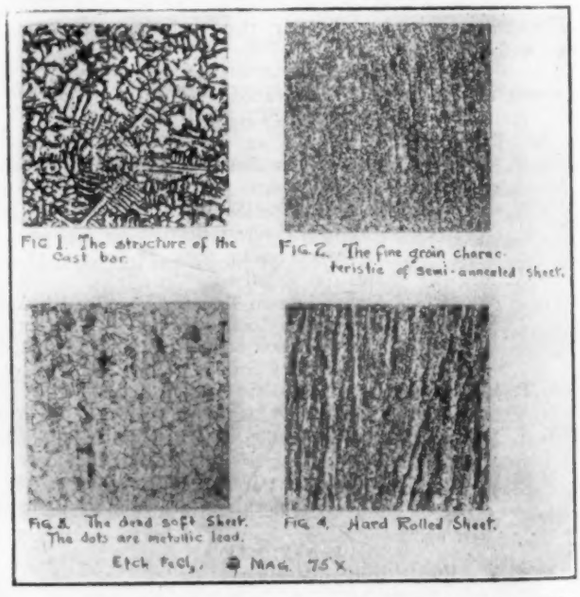


Fig 1. The structure of the cast bar.
Fig 2. The fine grain characteristic of semi-annealed sheet.
Fig 3. The dead soft sheet. The dots are metallic lead.
Fig 4. Hard Rolled Sheet.
Etch FeCl3. Mag. 75X.

PLATE 13. MICROSTRUCTURE OF CAST WATCH NICKEL

condition the three main constituents are thoroughly dissolved, nevertheless, upon solidification there is a tendency for a state of non-uniformity to exist. A mixture containing the highest melting constituents (viz., highest nickel content in this case) solidifies first and branches out forming the backbone of each crystal. Then material containing less and less nickel builds up around these

*Parts 1 and 2 were published in our issues of January and February, 1923.

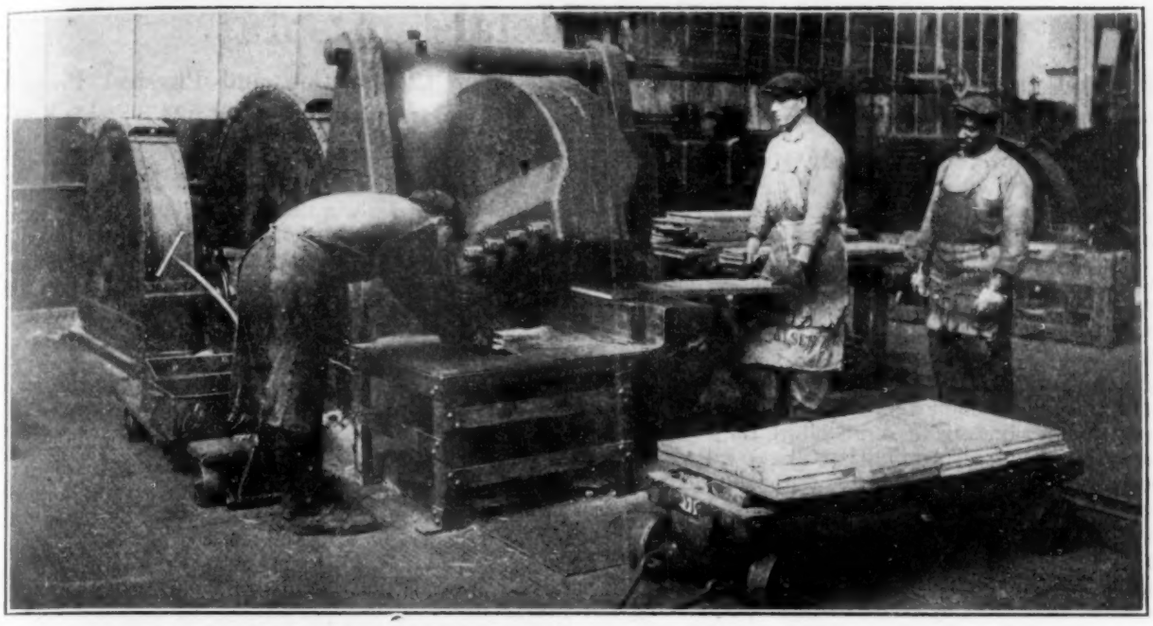


PLATE 14. CUTTING OFF UNSOUND METAL WITH GATE

branches or dendrites (Greek meaning tree form) until their growth is checked by coming in contact with other growing crystals. The juncture between two such crystals is the crystal boundary and naturally contains the lowest melting combination of constituents. From this it is evident that each individual crystal is very non-uniform in composition from center to outside but, nevertheless, may be quite similar in composition to its neighbor.

When metal is allowed to cool slowly and without disturbance, comparatively few crystal nuclei are developed and consequently the crystals are few in number and large in size. When the cooling is rapid, a large number of nuclei is developed which means many crystals of small size. This explains why chilled castings are much finer in texture than slowly cooled ones. The structure of cast watch nickel is shown in Plate 13, Fig. 1.

Upon rolling and annealing the watch nickel, diffusion takes place witnin the crystals so that the difference in composition between the center and outside of the crystal gradually disappears. Furthermore, the large cast crystals are broken up into smaller fragments and a new set of crystals form which are much smaller than the original cast one and give the metal the quality possessed by wrought metal. Even the original cast crystal boundaries disappear, thus changing the original character of the alloy and making it act more like a pure metal in appearance and behavior.

The structure of watch nickel sheet softened moderately by the heat treatment is shown in Fig. 2. Note the fine crystalline structure and the dark ridges indicating incomplete diffusion of the nickel. Where greater ductility is required the metal is heated at a higher temperature with a resulting larger crystal size and more homogeneity as shown in Fig. 3. The black dots are the little particles of lead present in the alloy.

The structure of the finished watch nickel is shown in Fig. 4. The metal is finished hard rolled in order to give it the proper stiffness. The dark ridges are quite prominent and indicate incomplete diffusion of the nickel. This gives the metal added rigidity which is desired in watch plates.

This paper will be concluded in an early issue. —Ed.

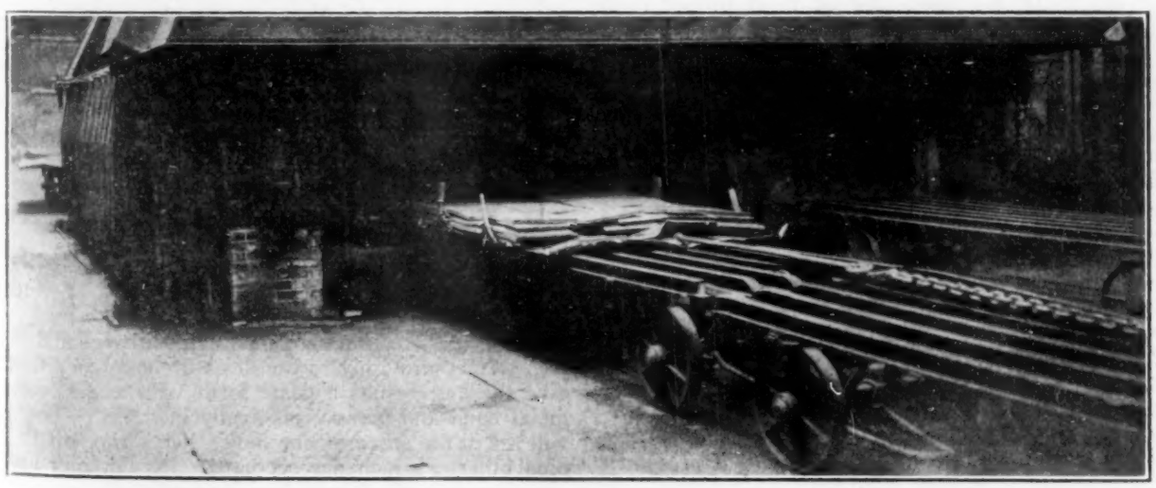


PLATE 15. ANNEALING MUFFLE

White Metals

A Review of the Principal Classes of White Metals, Their Composition and Physical Properties, Chiefly in Relation to Their Uses and Manufacture.—Part 3*

By A. H. MUNDEY, C. C. BISSETT and J. CARTLAND

SECTION II

PRINTERS' ALLOYS

The application of white alloys to the art of printing involves a much larger amount of technical consideration than is usually supposed, and the industry is a very important one.

In the days of hand composition, when single movable type was universally employed, the problem was a comparatively simple one from a metallurgical standpoint. An immense amount of printing is still carried out from type set up in the forms by hand, but a much greater volume of work, as in the case of newspaper, periodical, and large editions of book production, is turned out by employing machine type-setting, as in the linotype, typograph, and intertype machines.

The older fashioned single movable type is cast in typecasting machines, the metal being admitted into a three-part mold, two members of which produce the body of the type, while the third part, termed the matrix, has engraved upon it the particular character or letter into which the molten metal is forced, producing the face or printing portion of the type. The molds are fitted with great accuracy, the operations of opening and closing during the pumping of the molten metal through the mouthpiece, the removal of the tang of metal corresponding to the head of metal in an ordinary casting, being mechanically carried out with the utmost precision and rapidity. The metal varies according to the size and character of the type, but consists generally of 5 to 20 per cent tin, 25 to 30 per cent antimony, and the balance lead.

It will be easily recognized that small quantities ot foreign metal, oxides or sulphides, would tend to stop up the mouthpiece and to retard manufacture. The evil effects of impurities are made manifest to a much greater extent in the more elaborate type-setting machines.

The linotype machine is a beautiful piece of mechanism, which permits one operator, by working at a keyboard similar to that of a typewriter, to assemble in position a series of brass matrices, corresponding to the line of print to be produced; these matrices form the front part of the mold, the remainder of mold proper is of steel in four parts and corresponds to the body of the slug to be produced. A simple movement of a lever actuates a pump and molten metal is forced through a series of holes in the mouthpiece of the pot into the mold. The casting or slug, having on one edge the line of type faces, is trimmed by sharp knives, is ejected from the mold and placed into position in readiness for the form.

The metal generally used for this work is approximately of the composition 2.5 to 3 per cent tin, 10 per cent antimony, 87 to 87.5 per cent lead.

The physical properties of this alloy are:

Tensile Test		Brinell Hardness Number	Compression Test. Tons per Sq. In.	
Tons per Sq. In.	Elongation per Cent. on 2 In.	10-mm. Ball, 500 kg.	Yield Point, 0.001 In.	Compressed to Half Length
4.58	2.1	24.5	2.588	13.820

This alloy solidifies at about 238° C., and has no prolonged period of solidification (it corresponds to the eutectic in the majority of the alloys). This is necessary, as the operations of casting, solidification, trimming, and ejection are so rapid in succession. The requirements are an absolutely fluid and mobile metal, absence of contraction, thus ensuring a sharp casting, rapid solidification, and only the slightest expansion on solidification, or the ejection of the slug is hampered.

The alloy is the softest and weakest of the series. This does not matter, as the long slug gives mass support to the type, to resist the compressive and slight bending stresses in service.

Purity of the constituent metals is most important, traces of copper giving rise to a constituent which solidifies about 40° C. higher than the bulk and clogs up the holes of the mouthpiece. Zinc is fatal; it is not soluble in the alloy, but forms spongy, soft, solid masses. Nickel, iron, sulphides, and oxides are sure causes of trouble.

The intertype, linograph, typograph and similar machines are much like the linotype in principle, the metal used is practically the same, but as the apertures to the molds are in some cases larger and in slot form instead of a series of holes, a slightly harder metal is permissible in these—that is, one containing a higher proportion of tin and antimony.

The other important machine for typecasting and setting is the monotype. This consists of two separate members, first the keyboard, by which the operator manipulating the keys causes the machine to punch holes in a long paper band, producing a roll or spool of paper somewhat like a pianola roll. This is transferred to the caster, and as the perforated paper rotates compressed air impinges upon it and passes through the holes, actuating the mechanism, which brings an appropriate matrix into position; instantly this is presented to the end of the mold, the pump forces a small quantity of metal into the mold and the single letter is cast. These letters are collected in proper order and placed into position automatically. The mechanism of the machine is very intricate and ingenious.

As the name implies the type cast are single and separate, they therefore require to be stiffer and harder than those cast into line slugs, not having the mass support of the latter. There are, however, compensating advantages; the small size favors very rapid solidification, more tin and antimony can be employed in the alloy without risk of dangerous segregation, and type of extremely fine face can thus be produced.

This article will be continued in an early issue. —Ed.

*Parts 1 and 2 appeared in our issues of January and February, 1923.

Gluing Glass to Metal

Q.—Can you inform us of a formula or a manufactured product of a glue or paste, that will firmly hold a glass ring in a metal band. The smallest size ring is 3/32″ in width and ⅜″ in diameter, the largest 5/16″ in width and 1″ in diameter.

A.—Use a preparation composed of litharge and glycerine. Mix thoroughly to the desired consistency that will give the best results a paste form. Place the cement in metal band and press glass firmly in same. The cement will set in the space of one hour, then scrape off the surplus litharge which has set hard. Do not mix in large quantity as it sets hard when exposed to the air.—P. W. BLAIR.

Meeting of the New York Platers

A Report of the Meeting and Annual Banquet of the New York Branch, American Electro-Platers' Society, Held on February 17, 1923

On Saturday, February 17, 1923, the New York Branch of the American Electro Platers' Society held its 14th annual banquet and open meeting at the Aldine Club, 200 Fifth avenue. The educational meeting was presided over by C. H. Proctor, founder of the Society and Plating Chemical Editor of THE METAL INDUSTRY.

Mr. Proctor called the meeting to order and introduced Philip Morningstar, the president of the New York Branch, who made a short address of welcome. Mr. Morningstar then returned the chair to Mr. Proctor, who remained in charge for the rest of the session.

Papers were read and discussed. Abstracts of these papers are as follows:

ETCHING ON BRASS

BY P. MORNINGSTAR

Mr. Morningstar showed a number of unusually fine samples of etching on high grade brass. He used a resist of ordinary asphalt paint (in turpentine). The etching medium was composed of one part nitric acid and three parts water. He stated that the brass must be of a very high grade in order to produce good work; the type of etch as well as speed can be varied by varying the concentration of the acid. High lights were relieved with a walrus hide wheel oiled with 3-in-1 oil. Time of etching was approximately one hour.

GILDING RELIGIOUS GOODS AND CHURCH WARES

BY MAX STOKER

Mr. Stoker showed some very attractive samples of gold plated ware, one of which was a large chalice. In this work a heavy plate is required on account of the large amount of handling which the articles receive. In most cases, the base is sterling silver; in some, however, brass and nickel silver are used.

The work is first polished; then the greasing and buffing composition are washed off. The articles are dried and weighed to determine the loss of silver by comparing them with their original weight. They are then cleansed in an electro cleaning bath, scratch brushed, cleaned again and plated in a cold solution. Records are kept very accurately of the weight of the finished article, the temperature of the solution, the anode surface, the amount of anodes taken into solution and other particulars in order to maintain a standard weight of deposit.

After the article has been plated, it is removed from the tank, rinsed, scratch brushed, cleaned, given a flash in a hot gold solution, rinsed and finally dried.

Mr. Mackey explained his method of handling gold plated ware of this sort and outlined some interesting ways in which to cut out the final flash in the gold solution. He stated that he plated his work direct in a cold solution, using fine iron sling wires instead of copper.

ART BRONZE FINISHES

BY E. N. BINTNER

The base of these articles is cast zinc. The work is cleaned in triple X lye and put through an acid rinse consisting of sulphuric acid, 1 oz.; nitric acid, 1 oz.; water 1 gallon. It is then plated in a cyanide copper solution composed of sodium cyanide, 8 ozs.; red cuprous sulphide, 4 ozs.; water 1 gallon. This solution is used cold. After removal and rinsing, the work is scratch brushed, put through a brass bath of the same formula as the above copper bath with the addition of ½ pennyweight of zinc and 1½ to 2 ounces of ammonia water. The article, after removal from this bath is rinsed and plated in a gold solution for one to five minutes depending on the plate desired. This solution consists of sodium cyanide, 2 ozs.; gold, 2½ to 3 pennyweights; caustic soda, 1½ pennyweights; hyposulphite of soda, 1 oz.; sodium ferrocyanide, 1 oz.; phosphate of soda, 4 pennyweight. Mr. Bintner stated that this solution was used cold; that it was excellent for high grade bronzes; that he had plated castings which weighed up to 150 pounds. He claimed that there was no foreign metal in his solution because it was not heated and therefore did not attack the base metal of the articles to be plated. He could darken the color of the deposit by increasing the current.

William Voss pointed out that a cold solution called for more gold and cyanide, and was, therefore, more expensive to keep.

Royal Clark suggested that to eliminate the contamination of the solution by the copper slinging wires, it was helpful to give them a preliminary nickel flash. Since the cyanide does not attack the nickel, there would be no absorption of foreign material in the solution.

E. N. Bintner stated among other things that the present day sodium cyanide was of very poor quality and did not compare with the old potassium cyanide. J. A. Stremel answered this by stating that in his experience the sodium cyanide produced much better results than the potassium cyanide. The consensus of opinion throughout the meeting seemed to be with Mr. Stremel.

HYDROFLUORIC NICKEL SOLUTIONS

READ BY PHILIP UHL

Mr. Uhl read a description of a method of making up and maintaining a 800 gallon single nickel solution which had originally been a double salt solution.

THE PRODUCTION OF IMITATION ANTIQUE SILVER FINISHES BY THE AID OF ALKALINE ZINC DEPOSITS AND ANTIMONY OXIDE

BY C. H. PROCTOR

Mr. Proctor traced the development of art finishes, such as polychrome work from its early days. The particular work which interested him at the moment was imitation of antique silver on furniture trimmings. His methods were approximately as follows. The work was cleaned, polished, etc., in the usual fashion. The base could be of any metal, such as copper, bronze, brass or steel. After the necessary cleaning operations, the work was plated in a zinc cyanide solution of the following proportions: water, 1 gallon; sodium cyanide, 4 ounces; zinc cyanide, 4 ounces; caustic potash or soda, 4 ounces; mercuric compound, 1/16 ounce. These proportions can be increased as desired; in fact, even doubled to speed up the deposit. Temperature, 120 degrees F. at 4 volts; amperes, 25 to 40 per square foot of surface area. Anodes should be made of pure zinc. After plating, wash in cold water, and immerse in the following oxidizing solution: water, 1 gallon; caustic soda, 1 ounce; antimony oxide, ¼ oz.; temperature 140 to 160 degrees F.

This solution produces the black deposit. When this oxide is formed, remove the articles from the solution and wash in cold and then in boiling water. Relieve by any of the usual methods for relieving antique or silver plated work. Apply a coat of lacquer to the articles to protect the surface.

Mr. Proctor stated also that an excellent black color could be produced upon zinc by the precipitation of lead sulphide. A solution can be prepared as follows: water, 1 gallon; sodium hyposulphite, 2 ounces; lead acetate, 1 ounce; acetic acid, 1/32 ounce; temperature 140° F.

Mr. Proctor added that when using the antomony oxide solution, the zinc surface should be colored at once and not allowed to dry before coloring. Moreover, that if any metal was difficult to oxidize by immersion, like cadmium, this difficulty could be overcome by plating a thin film of zinc upon it and then applying the antimony oxide.

After the technical session was ended H. H. Smith of the Newark Branch announced that on the 21st of April, at 3 P. M., the Newark Branch would hold its annual open meeting and banquet. Walter Mitchell, Superintendent for Factory for Tiffany & Company was expected to speak at that meeting and also Dr. Blum of the Bureau of Standards. A cordial invitation was extended to everybody to attend and to bring the ladies with them. He congratulated the New York Branch on its excellent meeting and proposed a rising vote of thanks to the committee which had arranged it. This vote of thanks was quickly carried through. O. J. Sizelove also of the Newark Branch spoke a few appropriate words. He asked in particular, support and encouragement for the work being carried on by the Bureau of Standards. He stated that the Standardization Committee was particularly active and doing excellent work.

BANQUET

The banquet was held shortly afterward and was followed by dancing. The meeting and the social features were typical New York branch affairs, in that they were full of educational value and enjoyment.

Polishing Room Layout

By B. H. DIVINE, President Divine Brothers Company, Utica, N. Y.*

Can you tell me why it is that a polishing room is so often relegated to a dark basement or to some out of the way corner, unless because, psychologically, the job is a dirty job and the boss thinks any old place will do?

There is no place in a plant where light is more needed than in a polishing room, especially on fine work, to enable an operator to see exactly what he is doing.

Nowadays, the modern polishing room is a well-ventilated, well-lighted place. The floors are generally concrete, the machines are heavy and substantially equipped with the proper type of bearing carried out as close to the wheels as possible considering the character of the work, overhead belts are eliminated wherever possible, under-drives are substituted—brakes are taking the place of the inconvenient belt shifter. In some factories, of course, conditions do not make it possible to put in under-driven lathes, but the general tendency is that way.

POLISHING EQUIPMENT

The direct connected electric driven machine is also fast becoming an element. There has been one serious drawback, that is, with A. C. motors the speed is not variable and with a fixed shaft speed it is sometimes difficult to reconcile the diameter of the wheel necessary to secure the periphery speed with the character of the work and the speed needed for it.

As an instance of the lack of knowledge on polishing conditions, where plants are equipped by engineers who are not familiar with such conditions, I have in mind a plant which I was asked to inspect before operations were started.

I found a beautifully arranged room, concrete floors, plenty of light, everything fine, but their motors were squirrel cage motors, and they had forgotten that emery dust would wear out the bearings and cause general destruction sooner or later.

I wrote a magazine article and criticised this installation, and the president of the concern some time later recognized the description and invited me to his office and started to become sarcastic about my criticisms.

I suggested that they enclose the motors, and he said —"How are you going to ventilate those motors, if you enclose them?" And my reply was—"Put a stack on the motors." It was a perfectly simple thing to do, but the installation engineer had not thought it was necessary.

Too much cannot be said in regard to an efficient blower and good solid hood construction. There are concerns nowadays who make a special business of hoods, and I am glad to say that they are making them heavier, the hinges are made stronger, the hoods are easy to open and close and are usually so arranged that no more of the wheel is exposed than is absolutely necessary to handle the work.

In a good many, polishing frames are now designed so that the blower duct is cast into and is a part of the column of the machine. This does away with projecting sheet metal parts and makes a first-class compact unit.

SPECIAL MAN FOR RE-HEADING WHEELS

The old idea of each polisher being permitted to take care of his own wheels, taking time from productive work in order to rehead his own wheels because he thinks no one else can do it as well as he can, is passing. There is no reason why the heading of the polishing wheels should not be just as standard as the grinding of tools.

This has lead to the installation of a wheel man taking entire charge of the wheels, and includes the handling of the glue and naturally carries the inference with it of a glue room especially arranged and separate from the polishing room.

INSERTING AND REMOVING ARBORS FROM WHEELS

The manner of inserting tapered arbors in polishing wheels and removing them is a matter that needs some attention, particularly in cutlery shops where practically all the wheels are used in cupola jacks on tapered arbors.

Some people simply put the arbor through the wheel and smash the arbor down onto a block or on the floor, with the result that the wheel gets loose.

The most common practice is for the operator to drive the wheel onto and off the arbor with a hammer. Of course this ruins the hub of the wheel. In the first place, it sooner or later spoils the taper and the wheel does not fit the arbor and is out of round. In the second place, it breaks the hub of the wheel, and, in the third place, any man who uses a hammer on a polishing wheel, ought to be fired on the spot.

Some people use the anvil block with a V-shaped end, rest the wheel on the block and drive in the shaft, using a piece of leather under a hammer on the point of the spindle. This is bad practice because the point becomes battered due to the leather cutting through.

The best plan is to use an arbor press, with the throat deep enough to take large size wheels and with a ram and lever large enough to seat the shafts firmly in the wheels but not large enough to split the hubs.

*From a paper on The Metal Finishing Industry, read before the Meriden Branch, American Society of Mechanical Engineers.

Chromium Plating

A Paper on the Properties of Chromium and Methods of Electro-deposition*

Translated and Abstracted for The Metal Industry by R. E. SEARCH, Exchange-Research Editor

Chromium has a melting point of 1510 to 1553 degrees centigrade, according to various authorities who are not in agreement upon the matter. Like Selenium, Molybdenum, Tellurium, Tungsten and Uranium, Chromium has a valence of six. Because of its changeable valency it is a difficult metal to handle electrolytically. According to its method of preparation with acids chromium shows distinctly more or less pulsations. Many other metals show the phenomena of being soluble rhythmically, in which the time interval is inserted, but with chromium, this persists in the passive state.

If two bars of chromium are used, one as an anode and the other as a cathode in a conducting fluid, then the metal at both poles goes into solution; at the cathode with an evolution of hydrogen and it changes to a greenish chromium salt; at the anode the metal changes into the yellow chromate. If the current is broken, then only the metal at the cathode is susceptible of being dissolved by a dilute acid, while the anode becomes passive. By reversing the current one can at will convert the active metal into the passive state and vice versa.

Until lately the process of plating chromium upon other metals has been uncertain and unreliable, yet certain details of the operation have been known for a long time. By the formula which will be given and the proper current density, and a suitable anode which will be fully described, the deposition of sound durable coatings of chromium upon such metals as iron, copper, brass, nickel, etc., has become successful. The coating so produced is also immune from corrosion in the air. It is also immune from the attack of all the inorganic acids with the exception of hydrochloric acid and hot sulphuric acids, and from the attack of all the organic acids and all the alkalies.

In some of Dr. Guertler's recent experiments he produced a non-rusting (stainless) steel that contained 20.1% of chromium and it was found that it could be guaranteed against rust.

The special properties of chromium arise from the fact that it shows a potential equivalent almost equal to that of the noble metals, and chemically it is as resistant to oxidation under certain conditions. Furthermore its potential can be easily altered, especially in contact with the common metals such as iron and other metals of the iron group, without losing its chemical resistance.

By electroyltic methods chromium can be made to deposit a coating that is especially suitable for the protection of iron or steel against rust. Previous to this investigation Dr. Bauer had tried out various methods of protecting iron against corrosion, but he did not at that time (1920) extend his studies to chromium, because apparently its resistant properties were unknown to him.

For years, however, electro-chemists have endeavored rather unsuccessfully to find a way of depositing chromium in an adhesive state upon other metals. Their difficulty arose from the fact that the conditions by which chromium could be deposited from its solutions were practically unknown; they were puzzling to understand from the complex valency of the metal itself and because the proper kind of anode was unknown.

A deposition of metallic chromium with a very high current density from a chloride solution was first successfully achieved by Bunsen in 1850. (R. Bunsen, Ann. Phys. (2), vol. 91, 1850, p. 691.) For a long time, until about 1890, no one had followed up Bunsen's success, and up to that time it had been difficult to obtain the metal electrolytically deposited. All the scientific investigations, and there had been many, up to that time had amounted to nothing of a practical value, because the electro-chemical ratio by which the metal can be obtained as a deposit on the cathode had not yet been accurately ascertained, and the conditions of a successful deposit of the metal could not be determined.

Afterwards, however, according to Dr. Liebreich, and recently by studying the so-called periodic phenomena in the electrolysis of chromic acid, that is of the strikingly rhythmical fluctuations (pulsations) of the cell voltage with equal resistance of the outer circuit, the knowledge was obtained that in the electrolysis of chromic acid and also of other chromium salts at the cathode there took place by degrees a gradual reduction of the chromic to chromous salts which was the key to the solution of the problem. If any one is interested in learning how to reduce high valency to low valency cations, and especially the conversion of chromic to chromous salts, he can find full particulars of the steps to be taken by consulting page 602 of the third edition of Fritz Foerster's "Elektro chemie Waesseriger Loesungen."

It is shown that the voltage curve (that is to say, a curve showing the slope of the metal bath voltage while the current was flowing through the electrolyte) had divided itself into several branches running parallel to one another (Fig. 1) of which only the outermost one (Curve 4 of Fig. 1) corresponded to the deposition of metallic chromium.

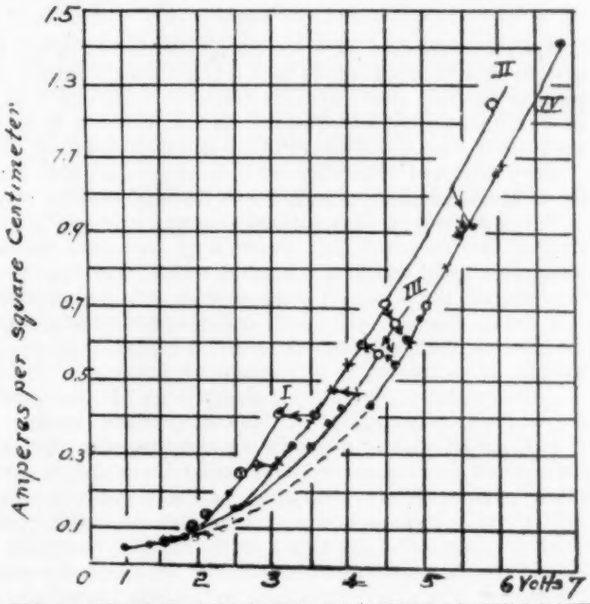


FIG. 1. VOLTAGE CURVES FOR CHROMIUM PLATING BATH

With this manifestation there are encountered the periodic phenomenon, previously referred to, which, because of the changing values of the concentration, causes the potential to change from one branch to another branch. From this fact it follows that with the use of a suitable chromic salt changed to a chromous salt solution such

*By Dr. Erik Liebreich from Zeitschrift fur Metallkunde, Sept. 1922, p. 367.

changes could not take place and the reduction at the cathode would be conducted uniformly alike for the deposition of the metal, as, in fact, is the case.

Fig. 2 shows the voltage curve of such a current without change of the potential. At the same time with this discovery the uncertainty was removed as to the deposition of the metallic chromium.

So far as the text of this article goes there is nothing definite stated as to the character of the electrolyte, nor as to the nature of the anode. In order that any one may carry out this work it is necessary to give some account of the difficulties of the process, the formula to be used and some interesting facts about the anode that is recommended.

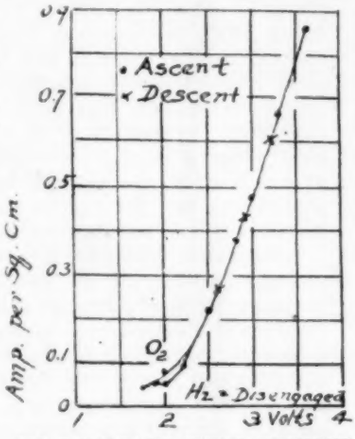


FIG. 2 VOLTAGE CURVE WITHOUT CHANGING THE POTENTIAL

Chromium in its electrolytic deposition is very much inclined to exfoliation and also to occlude hydrogen within its pores. H. R. Carvell and B. E. Curry, Jour. Phys. Chem. (Vol. 9, 1905, p. 353.) In all probability it is similar in its chemical behavior to the metals of the iron group. Nevertheless, dense and adherent but thin coatings of chromium may be obtained (F. Salzer, D. R. P. 221472; and 225769, 1907 and 1909) respectively, if along with the chromium salt there is added chromic acid to the electrolyte; by this means the overloading by the hydrogen will be reduced and the exfoliation of the chromium will be prevented.

FORMULA FOR THE ELECTROLYTIC DEPOSITION OF CHROMIUM

Take a solution of 12% Cr $(SO_4)_3$ with 13% CrO_3 and add to it a solution of 11% Cr_2O_3. This mixture will form a suitable electrolyte by which a beautiful coating of chromium may be obtained on the cathode if at the same time a lead dioxide (PbO_2) anode be used.

The principal difficulty in carrying out the above electrolysis is in the preparation of the lead dioxide anode.

For sulphuric acid solutions one can use, with good results, anodes which are coated over with lead dioxide, which is a good conductor of electricity. Any base metal or material upon which lead dioxide can be deposited in a dense, compact form, will make a good anode. Lead dioxide compressed into bars of a suitable shape for anodes, in Germany, is a commercial article.

Unfortunately, generally, such coatings of lead dioxide are at first very porus. If the electrolyte consists of H_2SO_4 or sulphates, then the almost insoluble lead sulphate must form a protective coating upon the anode at a low current density; on that, in the pores remaining, the current density is now increased and the anode potential is so great that by this means the lead changing in the electrolyte appears in the form of the 4-valency metal ion and it gives a considerable oxidation potential. If the H_2SO_4 has a specific gravity of at least 1.7, then the plumbic bisulphate—$Pb(SO_4)_2$—that is formed, becomes saturated in its solution and crystallizes out from the electrolyte when the acid for this salt is saturated. Since however the lead bisulphate is readily liable to hydrolysis, thus:

$$Pb(SO_4)_2 + 2H_2O = PbO_2 + 2H_2SO_4$$

then, in dilute H_2SO_4 it can remain permanent only in a small volume; instead then of the appearance of the almost insoluble PbO_2 the anode becomes immediately coated over in the places where the primary current had produced the bi-sulphate. By means of the separation of this second almost insoluble body originally present in the pores, its cross-sectional area will be reduced still more; since, however, the lead dioxide adheres firmly to the anode, and on account of its good conductivity the current can again pass through. As for the di-valent SO_4 present, nothing more is forthcoming by means of which it could go to the assistance of the current with a reciprocal effect, therefore it is decomposed, accompanied by the evolution of oxygen. Since moreover, on all lead anodes there is required possibly the reactions of the highest potential, the slightest reaction everywhere will take place upon the anode, where as yet no dioxide has formed. A lead anode in dilute H_2SO_4 will be coated over with **lead dioxide** and change into an almost insoluble anode.

By increasing the current density or by lessening the absolute or the relative concentration of the soluble salts one can reduce the distance from the anode at which the almost insoluble salts form, in so far as it is again coated over, but in such a porous layer that now the anode's far reaching reaction consists in the production of the four-valent lead ions, which are therefore formed away from the anode where gradually a denser nascent layer or coating of the lead dioxide is formed.

This phenomenon may be made clearer by the following experiment:

In a 20% solution of H_2SO_4, a lead strip will act as an anode, with a current of 0.01 ampere per square centimeter, immediately after shutting off the current, if hydrogen is already escaping from the cathode opposite. Yet no oxygen will develop, but after a few seconds this gas will appear in a regular current and the anode previously bright will soon be colored brown from the PbO_2. If, however, one uses a solution of 0.05-N-H_2SO_4, which contains 3 grams of $KC1O_3$ to one liter, then with the above named current density there will fall a slight cloud of lead sulphate upon the anode; apart from that oxygen will be generated; the anode will remain bright. If, however, the electrolyte again is 20% H_2SO_4 to which is added 12.2 grams of $NaClO_4$ to the liter, then almost all of the oxygen generating fails to occur, then also no lead sulphate will be precipitated, and the lead anode will be changed with almost a theoretical current efficiency into lead dioxide.

By using the formula already given, referring to curve, 4, of Fig. 1, and plotting the amperage on the curve, the voltage corresponding to a current density of 0.1 amperes per square centimeter would be 2 volts, and any other corresponding relation can be derived from the curves in either Fig. 1 or 2 in the same manner. Carveth and Mott have reached the conclusion that temperature has a very decided influence upon the efficiency of the deposition. Some very good deposits have been obtained with a temeprature as high as 90 deg. C. The investigations of both H. R. Carveth and H. E. Curry and W. R. Mott contain a veritable mine of both theoretical and practical information about the electrolytic deposition of chromium.

The investigations of chromium deposited in the manner as suggested by Dr. Liebreich have continued for over a year. The physical properties of electrolytically deposited chromium are of great economic interest. This deposit upon copper, brass and nickel, is compact, hard and adherent. Depending upon the condition of the electrolyte the physical appearance changes from that of a gray powder to a mirror-clear luster. The gray pow-

dered deposit with a longer application of the current than usual, thickens to a dense solid metallic layer with a steely aspect; by this treatment a fast, adhering coat, at least one millimeter thick can be obtained, while with the lustrous deposit the thickness reaches only one-tenth of a millimeter.

The yield from the dull surface chromium amounts to about 0.160 grams per ampere hour or about 50% of the theoretical amount calculated from a six-valent chromium compound. With a suitable composition this amount can be increased, while with the lustrous composition the amount obtained is only about one-third of that of the dull surfaced chromium.

Bending tests of both kinds of deposition upon a nickel surface have shown an adherence of equal strength.

With regard to the depth of the deposit obtained the dull deposit shows a considerable advantage over that of the lustrous deposit. With the former the deepening effect is unusually strong (as if perfectly alloyed to its basic metal); in this form it is preeminently suitable for technical purposes—such as the coating of all metallic tools that have to be dipped into sulphuric, nitric, or any of the organic acids.

The current density required for the deposition of chromium depends upon the overvoltage of the metal deposited at the cathode; generally it amounts to from 5 to 10 amperes per square decimeter. It is therefore about 5 to 10 times higher than what is required for depositing nickel. Carveth and Curry assert that the failure of so many chemists in their attempts to deposit chromium electrolytically is probably due to the use of too low current densities, combined possibly with the belief that it could not be done. Greater efficiency of reduction and metal deposition has been obtained by the addition of sulphuric than with hydrochloric or nitric acid.

It is indeed possible theoretically with a lower current density, down to as low as 2 amperes per square decimeter (especially upon iron) to deposit chromium, but in practice, on account of the time element, a higher current density will be found preferable.

Neither the lustrous nor the dull deposit change their appearance in the acrid atmosphere of a chemical laboratory, and the protected metal shows no signs of rust or corrosion of any description whatever.

Very coarse, rough pieces of cast iron coated with the dull deposit have been immersed in water for months at a time and not the slightest indications of rust or of corrosion have been discovered.

In the Berliner Stadtischer Gas Works experiments with chrome-coated piping were carried on for some time. For two months one of the large gas-mains in front of the cyanide washer was exposed to the gas current; even with such a severe test the chromium coating gave a complete protection to the piping against either rust or corrosion. Electrolytic plating, sherardizing, metal spraying of zinc, lead, brass, nickel or any of the other metals deposited by any known mechanical or chemical means would fail adequately to protect iron or steel or other corrodible metals under such an ordeal. As chromium does not alloy readily with copper, zinc or tin, its coating could be used to great advantage in protecting the delicate wires of a sensitive thermo-couple from dissolution when plunged into molten brass or bronze. It is unfortunate that no figures have been given as to the cost of such chromium plating, as its wonderful properties open to it a wide field of usefulness.

Abrasive Grains*

There are two forms of abrasive grains, natural and artificial. The mineral name for the natural grain is "corundum," the common trade name is "emery." Corundum is a volcanic deposit—the heat of which has produced gems, such as rubies, sapphires, emeralds, etc.

The largest deposits known which are commercially worked are in Canada. There are deposits near Poughkeepsie and near Chester, Mass. These gems are, of course, impure and are mixed with earth and rock and are of no more value except for abrasive purposes than the plain rock itself.

The minerals are mined, crushed, and are screened to separate the sizes for the market. A great many of the sizes which are produced are of no commercial use, and the high cost of producing commercial sizes has caused a sad ending to many concerns who expected to get rich in the manufacture of abrasive materials.

There is no known process by which the common "dirt," as we shall call it, can be separated from the gems themselves—the result being that the cut of the gem is modified by the presence of the common dirt and also the quality of the emery is likely to vary from time to time.

This very impurity is the reason why natural emery is commonly preferable to artificial abrasives for the production of high lustre. The modified cut of the emery, plus the grease used in the final operations, produces a lustre which it has not yet been able to secure with the artificial abrasives, which, by reason of their sharpness and hardness do not break down on the wheel and give the surface necessary for producing lustre.

I am very glad to say that improvements along this line have recently been made, and it is hoped that makers of artificial abrasives will eventually produce the softness required in the finer grains for finishing processes for it will greatly assist in establishing standards in the industry. It is perfectly apparent that the artificial abrasives for grinding and cutting processes must be superior to emery because all the grains are alike and run fairly uniform in shape and size and produce work of greater uniformity.

*By B. H. Divine, President, Divine Brothers Company, Utica, N. Y. From a paper on The Metal Finishing Industry read before the Meriden Branch, American Society of Mechanical Engineers.

Casting Silver Bars

Q.—I have difficulty in melting silver chloride and therefore ask you if you can give me some information. I am melting the silver chloride in crucibles, usually together with soda ash. After the melting the silver is granulated in water. After this it is remelted in a graphite crucible and cast in bars about 200 x 100 x 10 mm. These bars should be rolled into sheets, but it is impossible to get the bars right. As a result the sheets, after the rolling are cracked. The bars are cast in steel forms, heated a little for casting. How can we get the bars free from porosity? Is the temperature too low or is the metal oxidized.

A.—If you will use sodium carbonate and wheat flour, in the proportions of 10 ozs. silver chloride; 10 ozs. sodium carbonate and 2 ozs. of wheat flour, you should get an excellent flux and good clean malleable bar free from oxides. If the flux is not easily removed, a second melting may be advantageous but it would hardly seem necessary. It would be a good precaution to pass H_2S-gas through the solution before precipitating with HCl, if very highest purity of silver is desired. Do not overheat or the silver will occlude gases which results in porosity.—H. D. COLEMAN.

Standard Foundry Costs

Stop, Look and Listen to Government Form No. 1040 Schedule B with Its Productive Labor, Overheads and Burdens

Written for The Metal Industry by WM. H. PARRY, Foundryman

Now that Mr. Harper's article in your October issue on "Standard Foundry Costs" has prompted Mr. Churchill to differ with the methods employed, perhaps I may be allowed further to complicate matters by writing my little piece on this most interesting subject. Strange as it may seem, the average jobbing brass foundryman is not very strong on cost accounting, except that it is necessary to render in these parlous days a reckoning to suit government tax requirements, both federal and state, on printed forms that convert simple A B C propositions into X Y Z intricacies.

Now, far be it from me to rap our government in their efforts to collect the few dollars that most any jobbing brass foundryman is willing to hand over for the sake of peace. Not that the government is entitled to any, but that the jobber, rather than risk a period spent in a sanatorium or an insane asylum, follows the line of least resistance, splits his profits three ways, ninety-five per cent for himself, one for his wife and the rest for Uncle Sam and his home state. Which is a fair and equitable distribution to all concerned—especially for the wife.

Breathes there the man with soul so dead, who never to himself hath said, "Believe me, the Government must be pretty hard up to exact a tax on profits derived from the operation of a jobbing brass foundry."

Of all the precarious methods of earning a living, that business takes the bun, and the tempered copper razor blade.

Does the Government realize that many brass foundrymen are compelled to make most castings to specification requirements, and that the days when brass castings were made from hoop skirts, goloshes, old corsets, and lamp chimneys are gone, never to return?

So as to be in the "mode" I shall jot down here some figures that are available and easily understood, taken from a record book kept by a brass foundryman whose visions of enormous profits to be made in that line of high and mighty endeavor were rudely dispelled by a visit from the sheriff and his strong arm aids.

SPOOL CASTINGS

Bought 11,000 lbs. Comp. Turnings@8c per lb		$880
Charged 12c per lb. for Castings 10,000 lbs		$1,200
Returned turnings 7,000 lbs. sold@7c per lb		$490
Labor, fuel, material, overhead, chimney loss		$310
Cash received	$1,690	
Disbursements	$1,190	
Profit	$ 500	

Analyzing these figures, it will be noted that the spools when machined all over lost seventy per cent of their weight, thus accounting for the 7,000 pounds of chips returned, which, we may assume, contained the usual amount of steel and iron with which brass chips will associate in the best regulated machine or brass finishing shops.

The disappearance of 1,000 pounds of chips is about normal. At least it would be for entry in a Government tax report, though the so-called profit of five hundred dollars could be used to cover the losses incurred on jobs that not only did not show any profit but did actually show a loss.

Such, for instance, was a case in mind, that of a dozen castings in red brass of centrifugal pump rotors, not over seven inches in diameter and three inches across the face, shrouded on both sides. The actual cost per pound of these castings was eighty-four cents. The firm making them charged only forty-five, and would have been making them at that figure unto this day but for the insistence of the foundry foreman that there was no profit in the darned things at any price. The cause of this abnormal cost per pound was found in the manner that the pattern was made and mounted, on a contrivance that the owner insisted was the last word in foundry practice. It was nothing more or less than his idea of what a "stripping plate" ought to be, which was so complicated that none other than a man possessed of extraordinary strength and intelligence could operate it.

Here is a clear illustration that the price per pound will not cover every job. In fact, it can be used only on "tried out" work, that is to say, work where all conditions are known from past experience, plus or minus, the market price of materials used.

How often is the jobbing brass founder plagued by the transient customer who wants one casting from a pattern made of plaster of paris, wood, leather, cloth, or rubber, so fearfully constructed as to be next to impossible to mold. And he wants it right away, a speed he does not show when it comes to paying up. Let us assume that such a casting would weigh three pounds (they rarely weigh more) and the average price per pound at that foundry is a half a dollar. Do you suppose that a dollar and a half will pay for the necessary ripping apart of the pattern to make it moldable, plus the molder's labor and metal used, to say nothing of the cleaning and chipping?

The way to handle that kind of trade is to "give 'em the air."

Then there is the matter of returned castings, rejected because of some fancied defects hardly visible to the unaided optic. Government Form No. 1040, Schedule B, disdains to include this very important item, either under the headings "Productive Labor," "Overheads," or "Burden," nor indeed is the matter of bad castings or, as our English friends call them, "wasters" touched upon. Yet as every foundryman knows, this condition exists, and must be reckoned with. Judgment born of long and varied experience is, after all is said and done, the prime factor in the determination of the proper charges to make for brass castings, and any foundryman who relies on the making of a Government report for help in that direction, is headed straight for the bankruptcy court, or the "Hoosegow," perhaps both.

Price per pound is insisted upon by most customers, so that the foundryman is compelled to resort to little tricks, too numerous to mention here, to conform with their desires. Yet we know that service is always included in the pound price, for be it known that its inclusion is as necessary as the metal itself in the conduct of a successful brass foundry.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER, THE ELECTRO-PLATERS' REVIEW

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EDITORIAL

MEETING OF THE INSTITUTE OF METALS

The New York meeting of the Institute of Metals Division (reported on page 100 of this issue) was a longer and more ambitious one than has been attempted before but it was fully justified. Many of the papers were extremely important and all of them were valuable. The meetings were well attended and discussions lively.

The annual lecture, which has become a noteworthy feature of these meetings, was delivered by Dr. Walter Rosenhain of the National Physical Laboratory, London, England, who gave a most interesting and illuminating address on Solid Solutions.

Works of utmost importance is now going on which is clarifying many of the formerly obscure points in the question of the constitution and structure of metals and alloys. E. C. Bain, an X-ray specialist, told of the work which his laboratory was doing on metals. His papers were unusually stimulating, and the discussion which followed threatened to become almost metaphysical. J. D. Edwards read a paper on the Thermal Properties of Aluminum Silicon Alloys which have achieved considerable importance, and from all indications, should be a very prominent factor in the aluminum field. W. F. Meggers reviewed the use of the spectroscope and showed the possibilities of its application to metallurgy. It will be remembered that last year W. H. Bassett and C. H. Davis told of the spectroscopic work being done in the American Brass Company laboratories.

A very important paper covering a new method of testing bearing metals was read by C. H. Bierbaum. This paper gave the methods of using a new instrument called a micro-character. This instrument tests metals by the measuring of the width of a continuous sharp cut or scratch which on crossing several crystals is wider on some than others. The instrument will undoubtedly find a very important place for itself in the testing of such materials.

A very interesting and practical paper on Bright Annealing of Copper Wire was read by P. E. Demmler. The discussion by O. Lellep which followed showed the possibility of discolored copper annealed in a reducing atmosphere, being due to carbon rather than oxygen. Metallurgists and rolling mill men will look forward with interest to further work on this problem since it may result in great savings in bright annealing installations.

ADVANCE IN METALLOGRAPHY

In the February issue of Mining and Metallurgy is a very interesting summary of the recent advances in metallography by Zay Jeffries, Director of the Research Bureau of the Aluminum Company of America at Cleveland, Ohio. Dr. Jeffries covers the last twenty-five years very briefly, but at the same time, completely.

He states in opening that the science of metallography has broadened considerably, now dealing not only with the constitution and structure of metals and alloys but with the correlation of chemical composition, constitution, thermal treatment, mechanical treatment, structure and temperature with their physical and mechanical properties. This, of course, is the way in which the laboratory metallographist and the practical plant operator come together. In showing how the constitution and the structure of metals affect their physical and mechanical properties, metallographists are making the very best practical use of their science.

It seems that about 270 binary, 40 ternary and 3 quarternary alloy systems have been investigated up to the present time. Obviously much work remains to be done. From the time, in 1898, when Sauveur published his first iron-carbon diagram to the present, metallography has developed by leaps and bounds. In 1900, Taylor and White demonstrated their high speed steel, which Dr. Jeffries rates so highly as to call it the most important advance in metallographic art during the last twenty-five years. Vanadium steel and molybdenum steel have followed and stainless steel is the latest of this group.

The non-ferrous field has brought forward heating-element resistance wires like nichrome, ductile tungsten, and the development of aluminum alloys as strong as mild steel but with only 36 per cent of its density.

These are some of the spectacular achievements. However, fully as important is the fact that metallography makes possible the manufacture of materials which have certain predetermined properties, and which can be produced in quantity and with a high degree of uniformity.

New instruments include the Brinell and Shore hardness testers and magnetic testers for steels. Of tremendous importance also is the very recent use of the X-ray spectrometer in crystal analysis. This, Dr. Jefferies states, has revolutionized our ideas of the constitution of solids. Metallurgists now think of the crystals in terms of the positions of their atoms, and the work that has been done along these lines has helped greatly to clarify such questions as plastic deformation of slippage of crystallographic planes, grain growth in metals, the nature of intermetallic compounds. Season cracking has been for some time better understood and is under very good working control.

It is believed that whereas the present tendency is to think in terms of atoms, the next step will be to think in sub-atomic forms. The development of new alloys and new processes for treatment of metals is naturally becoming more and more difficult since most of the simple and obvious ones have already been taken up. For the future, development depends more and more upon the trained scientist.

SPRAYING MACHINES

In our issue of February, 1923, we noted in these columns the receipt of a communication from the De Vilbiss Manufacturing Company to the effect that legislation was pending in various states throughout the country against the use of spray-painting machines.

In response to our investigations, we have been advised by the American Federation of Labor that the bill presented before the Minnesota legislature prohibits the use of spray-painting "poisonous and dangerous paints and varnishes injurious to the health of workmen unless such machine is equipped with or operated under a safety device, to carry off all poison-

ous gases and fumes." Moreover, these bills seem to be aimed at the use of paint spraying machines, in particular, and not the spraying of lacquers or japans.

The fact of the matter is that spraying lacquer and japan is done almost always under a ventilating hood which draws off whatever injurious gases there may be generated under these conditions. We are advised by five lacquer and japan making concerns that such work is not injurious to the worker, and we have no evidence to the contrary. Moreover, if the Minnesota bill is to be taken as a sample, operations of this sort would be entirely within the law, and would not be affected by any such legislation.

It is our opinion that users of the spraying machine for finishing metal objects need have no fear about adverse legislation. So far as we have been able to discover such legislation is directed only against spraying paint without the use of safety devices.

METAL NOMENCLATURE

On page 116 of this issue will be found a letter from S. S. Tuthill, Secretary of the American Zinc Institute which urges the use of the word "zinc" throughout the trade instead of "spelter." It is needless to say that we are in complete agreement with Mr. Tuthill. For years The Metal Industry has been working for a sane and honest metal nomenclature.

In April, 1915, we commented on the fact that the metal was called "zinc" and "spelter" with no reason for the existence of "spelter." At that time there was supposed to be some mythical differentiation, but this classification did not stand the test of examination and the Zinc Institute finally decided to eliminate the name "spelter" and to call all forms of zinc by that name.

At the same time when it made this change, the American Zinc Institute also designated what was known as "galvanized iron" by the name "zinced iron." It will be noted that this was, of course, a much more difficult change to institute. Nevertheless, it should be adhered to and made standard throughout the industry. A great deal of confusion has always existed throughout the trade, both as to the exact meaning and the reasons for existence of such terms as "galvanized," "hot galvanized," "cold galvanized," "sherardized," etc. In the passive it might be well to review the meanings of these words.

Galvanizing has for a long time been the accepted trade term for the application of zinc to the surface of another metal. Hot galvanizing consists of applying zinc by dipping the other metal into a bath of molten zinc. Cold galvanizing consists of coating another metal with zinc in an electrolytic bath. Sherardizing is the name applied to a process invented by Sherard Cowper-Cowles. According to Flanders it is "a process of sublimation, occlusion and adhesion." The articles to be coated are heated in the atmosphere of zinc, produced by placing zinc dust in the furnace with the articles to be coated.

Mr. Tuthill's recommendations for names for these processes are decidedly to the point. We are heartily in accord with the work on nomenclature being carried on by the American Zinc Institute and have no doubt that their efforts will be successful.

TECHNICAL PUBLICATIONS

The issuance of Technical Paper 287, **Preparation of Light Aluminum-Copper Casting Alloys,** by R. J. Anderson, metallurgist, is announced by the United States Bureau of Mines.

In aluminum-alloy foundry practice, light aluminum-copper alloys are preferred for general use for castings, says the author; in fact, as far as can be estimated from the available figures, the domestic production of castings from an alloy containing approximately 92 per cent of aluminum and 8 per cent of copper was about 97 per cent of the castings in all kinds of alloys in 1920, which amounted to about 81,000,000 pounds. Several other binary aluminum-copper alloys are employed for commercial castings; these contain from 2 to 13.5 per cent of copper, the remainder being aluminum. Alloys containing 4 to 6 per cent of copper are reported to have been used in Italy for aircraft-motor castings, and the 96:4 aluminum-copper alloy is used extensively in the United States for sand-cast cooking utensils. In the United States a favorite motor-piston alloy is made with 9 to 10.5 per cent copper, the remainder being aluminum, but some plants introduce iron as well as copper to increase the hardness. Alloys containing up to 13.5 per cent copper have been used in England for special purposes. In the United States, the consensus of opinion among foundrymen is that the alloy containing 92:8 aluminum is the best alloy available for general casting purposes and for some special castings. In addition more or less definite light alloys have been developed for particular uses, notably piston and carbureter alloys and alloys for so-called leak-proof parts.

Technical Paper 287 may be obtained by addressing the Bureau of Mines, Washington, D. C.

The Effect of Gasoline Fumes.—A reprint from the public health report of September 22, 1922, of the United States Public Health Service on The Effect of Gasoline Fumes on Dispensary Attendance and Output in a Group of Workers, by Octavius M. Spencer. The conclusions arrived at are as follows:

1. The gasoline fumes liberated in the workroom studied had produced cases of mild chronic gasoline poisoning.

2. In workrooms where the ventilation is not adequate, the liberation of gasoline fumes from open containers or from processes will, sooner or later, depending upon the amount and the concentration of the fumes, produce cases of acute, mild chronic, or chronic gasoline poisoning.

3. The liberation of gasoline fumes above an undetermined concentration, in an improperly ventilated workroom, will result in increased dispensary attendance and absenteeism among the workers exposed.

4. Increased production and a lower rate of dispensary attendance were obtained by the removal of the gasoline fumes.

Mineral Resources of the United States for 1919. Published by the U. S. Geological Survey, Washington, D. C. This is the latest of the annual volumes on this topic. The volume on metals which is of particular interest to readers of THE METAL INDUSTRY is edited by G. F. Loughlin, geologist in charge.

Data on the production and, as far as possible, the consumption of the following metals are given: Cadmium, platinum, arsenic, bismuth, selenium, tellurium, magnesium, bauxite and aluminum, gold, silver, copper, lead, zinc, secondary metals, chromite, manganese, antimony, iron and steel, cobalt, molybdenum, nickel, tantalum, titanium, radium, uranium, vanadium, tin.

Optical Methods in Control and Research Laboratories, by J. N. Goldsmith, S. Judd Lewis and F. Twyman. Published by Adam Hilger, Ltd., London, England. Size 6¼ x 9¾, 60 pages.

This little book deals with optical methods employing spectroscopes (or spectrographs), spectrophotometers, refractometers and polarimeters. No detailed descriptions of these instruments or their techniques are included, but in each case references are given to sources of information on these points.

CORRESPONDENCE and DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein

CALL ZINC BY ITS RIGHT NAME

To the Editor of THE METAL INDUSTRY:

Referring to our recent talk on Zinc misnomers:

The American Zinc Institute was organized in July, 1918, and today includes in its membership the representatives of every Zinc mine of any consequence, every primary Zinc smelter and every Zinc rolling mill.

At its 1919 annual meeting a movement was initiated to "Call Zinc By Its Right Name," in the belief that the advertising value to the industry of the word Zinc far outweighed all that could be said in favor of the continued use of the word "spelter."

The word "spelter," in fact, is now seldom seen except in foreign Zinc news.

The current names of Zinc are:

(1) Zinc Ore,
(2) Slab Zinc,
Classified as:
High Grade Zinc,
Intermediate Zinc,
Brass Zinc,
Prime Western Zinc,
(3) Sheet Zinc,
(4) Strip Zinc,
(5) Zinc Plates,
(6) Scrap Zinc.

Where brands are mentioned the word Zinc (or "Slab Zinc") follows the name of the brand.

Zinc refers to metallic Zinc, and not to Zinc Oxide. Zinc Oxide should always be called by that name.

The current names of Zinc herein before listed have been adopted by all the Government Departments and by the trade and daily press.

The principal dictionary makers have so filed this information that it will be incorporated in the next revision of their works.

It has been rather difficult to convince the "Galvanizers" to adopt the terms "Zinced Sheet" or "Zinc Coated Sheet." We contend that, in view of the present complaints in respect to "galvanized" articles, their manufacturers would gain by more efficient Zincing of the Sheet and the retiring of the word "galvanized" in favor of a name that would suggest to the buyer that he is getting a product protected 100% by the chief of all protective coatings, Zinc. Is there, in fact, any more reason why a Zinc Sheet should be called a "galvanized sheet" than there is that a tinned sheet should be so called?

Another word that should be put into the discard is "sheradizing." While for sentimental reasons it may be all right to perpetuate the name of an inventor in connection with a product, yet in as prosaic a business as that of metal does not "Zincvaporized" best tell the story even to the uninitiated?

Zinc is Zinc no matter how used. Then why should Zinc lose its identity any more than any other metal?

S. S. TUTHILL, Secretary,
February 14, 1923. American Zinc Institute.

CASTING BRASS BOXES

To the Editor of THE METAL INDUSTRY:

Wish to compliment you on the January number of THE METAL INDUSTRY. It is of good value from cover to cover. I notice in the January number, page 29, an article, "Casting Brass Bixes." It is a letter that I wrote to you several months ago. At the time I wrote to all the leading authorities I know of on brass and bronze metals, with the exception of George Klink, with the Allis Chalmers Company of Milwaukee, Wis., who I presume is one of the best authorities in this country.

The singular thing about the matter was that each expert had a radically different opinion from the other. Mr. Reardon's answer to this question recommended just exactly what we did. Our oil pressure was 30; we raised it to 40 and we raised our air pressure from 12 to 20 ounces.

Our fuel oil comes from one of seven large tanks quite a distance on the side of the mountain and at this particular time the oil was dirty and about half water, which really caused our trouble. Our plant uses a great deal of fuel oil in what is known as the flotation process in the recovery of the copper values in milling copper ore.

We did not use, as Mr. Reardon suggested, ½% of 30% manganese, but continued to use 15% phosphor copper.

Thanking you for publishing the article, as it is some satisfaction to have a man of Mr. Reardon's reputation confirm the method that we have in use.

Garfield, Utah, T. F. JENNINGS,
January 26, 1923. Superintendent of Foundries,
Utah Copper Company.

SALT VS. AMMONIUM CHLORIDE

To the Editor of THE METAL INDUSTRY:

I have just been reading your February issue. In the article by Joseph Haas, Jr., he states that sodium chloride is slightly better than ammonium chloride for conductivity. I took this matter up with the late Erwin S. Sperry a few years ago. He wanted to know from my long experience in making the double chloride of nickel salts and running these solutions for years, if I thought that ammonium chloride was a better conductor than salt or sodium chloride. I claimed that ammonium chloride was much better than salt for conductivity. He tried these two salts out in his laboratory. The result was salt showed about 35% as against 75% for ammonium chloride.

C. H. BUCHANAN.

Hinsdale, Mass., February 12, 1923.

DIE CASTINGS FOR PLUMBING WORK

To the Editor of THE METAL INDUSTRY:

In the December issue of THE METAL INDUSTRY we read with interest your article on the die casting process. The saving made possible with this method over cast brass, particularly on the plumbing specialties, is obvious.

We wonder if you know how nicely the majority of small die castings polish in an Abbott burnishing barrel?

If any of your friends or subscribers would like to send in some die castings similar to the cut shown in the magazine we will be glad to finish them up for them for if they can be polished in quantities, both before and after plating this adds materially to the saving that you have already shown to be possible by your article.

THE ABBOTT BALL COMPANY.

Hartford, Conn., February 13, 1923.

NEW BOOKS

Aluminum Repairing, by William H. H. Platt. Published by Crosby Lockwood & Son, London, England. Size 5 x 7½, 70 pages.

This book treats of the repairing of aluminum sheet and castings, and attaching of copper, brass and steel to aluminum by tinning, sweating and burning processes. Explanations and illustrations are included showing the methods to be adopted in working these processes under their different headings. The detailed items covered are: Composition of aluminum alloys; treatment of castings subjected to oil and grease; tinning and burning process and the tools required; making joints in sheet aluminum; repairing cast pipes, broken lugs, radiator parts and gear cases. A number of other kinks are included. The book is simply written and illustrated so that all the explanations can be clearly understood. It is a very useful little volume to have in the library of both metallurgists and the works operators.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical; WILLIAM J. REARDON, Foundry; PETER W. BLAIR, Mechanical; LOUIS J. KROM, Rolling Mill; CHARLES H. PROCTOR, Plating-Chemical; R. E. SEARCH, Exchange-Research }

ANTIQUE BRONZE

Q.—Would ask you to kindly advise me what process you would suggest to give architectural bronze a dark finish of statuary bronze?

A.—Sulphur combinations are the factors in the production of antique finishes on copper or bronze, such as architectural bronze which is a combination of 50% copper and 44% zinc and is frequently termed extrusion metal. A solution of hydrosulphuret of ammonia applied to the bronze surface will give a dark finish. This chemical comes in liquid form.

The bronze should be cleansed thoroughly, possibly in your case steel, wool or sand or emery paper could be used to produce a clean surface unless you are in a position to cleanse the bronze under regular cleansing in plating methods.

If the bronze surface is heated previous to the application of the bronzing liquid, the dark tone will be produced more quickly and effectively.

It is possible that the hydrosulphuret ammonia can be mixed with an oil, such as olive oil or sweet oil, and applied. As a rule water is the reducing factor for hydrosulphuret of ammonia if the material is too strong in its original form. After the bronze tone desired has been produced, the surface of the metal should be washed thoroughly with water, dried carefully and afterwards oiled down with linseed oil or a wax mixture. If the hydrosulphuret of ammonia is mixed with oil, then water washing can be avoided. The excess of oil only requires to be wiped dry.

Polysulphide and sulphuret of barium, both soluble in water preferably hot, can be used for solution. The strength will have to be decided by experience. Another factor that will give excellent results is a mixture of golden sulphuret of antimony mixed to a fluid paste with aqua ammonia 26%. This mixture should be brushed upon the bronze as in painting. The surface of the bronze should be warm if possible. The coat of antimony and ammonia can be washed from the bronze surface with water, drying afterwards very thoroughly and oiling and waxing is advisable. —C. H. P. Problem 3,173.

CASTING BRASS WATERBACKS

Q.—We have made several attempts to mould a brass waterback without success. Apparently the casting is entirely satisfactory at the time it is poured but after tapping and subjecting it to a hydraulic test of 200 pounds the water seems to ooze out of the metal all over. This leakage is not confined to such points on the casting as the gate, chaplets, etc., but apparently the metal is porous all over.

We have used a wide variety of brass mixtures from 70 per cent copper to 90 per cent copper. If you can suggest any mixture of metals or any method for obtaining satisfactory brass waterbacks, we would very much appreciate hearing from you.

A.—It is very evident from what you say that your trouble in casting brass backs is in the metal. We would suggest a mixture of: 85 copper, 13 tin, 1 zinc, ½ lead and ½ of 15 per cent phosphor copper. This alloy will stand a hydraulic pressure of 5,000 pounds per square inch without showing any signs of leakage. I might say, however, the alloy must be handled properly to get the best results, and I suggest in handling the metal you melt the copper in a crucible coke or coal fire, placing a shovelful of charcoal in the bottom of the crucible, and charge the copper on that. Have a good bottom of coke or coal under the crucible. Keep the copper covered with charcoal and when melted add ¼ per cent of 15 per cent phosphor copper to the copper bath to deoxidize it. Then add the tin a little at a time, stir well after each adding of the tin, then add the zinc, then the balance of the phosphor copper and pour at about 2,000 degrees Fahr. Use good material for best results and just before pouring add a spoonful of common salt. Open flame furnace can be used as well if you are experienced in running them as they should be run; otherwise the crucible furnace is recommended.—W. J. R. Problem 3,174.

COLORING STEEL

Q.—Can you advise the writer of a cold solution which will color surface ground steel?

It is our desire to etch a design on steel in the usual manner after which we wish to lend the background a definite color other than what the normal action of nitric acid gives.

We wish to throw out the letters in relief against a colored ground if this is possible and due to the ink resist on top of the lettering it would not be possible to use a hot solution of any kind as it would act on the ink as a solvent.

A dead black, red, blue or any other fast color would meet our requirements.

A.—You have a somewhat difficult proposition to dead black, red or blue color direct upon steel by cold chemical solutions. The only suggestion that we can give that may be of value to you would be to use copper sulphate dip to obtain a red color. The film of copper so produced could be oxidized to a black by the use of a cold liver of sulphur solution. Or a white color could be obtained upon the copper by immersing the copper coated steel in a dilute silver cyanide solution. The copper sulphate solutions should be composed as follows:

Water	1 gallon
Sulphuric Acid	4 ozs.
Copper Sulphate	1 to 2 ozs.

Oxidizing Solution:

Water	1 gallon. Temp. 100° F.
Polysulphide or Liver of Sulphur	¼ oz.
Ammonia, 26%	⅛ oz.

Silver Solution:

Water	1 gallon
Sodium Cyanide	2 to 4 ozs.
Silver Cyanide or Chloride	⅛ to ¼ oz.

or as may be required to give a silver color. An electro green deposit could also be applied to the steel from the following solution. Copper should be used as anodes:

Water	1 gallon
Potassium Bichromate	12 ozs.
Copper Sulphate	4 ozs.

Voltage 2 to 4.

The solution can be used cold. The deposit is a yellowish green. If after the green is deposited, the steel coated surface is immersed in a solution of sal ammoniac and water, a blue green will result. From two to four ounces of sal ammoniac per gallon of water will probably be ample. A coating of lacquer will be required to protect the surface of the steel after coloring.—C. H. P. Problem 3,175.

LEAD AND ALUMINUM

Q.—We are making billets approximately 1¼" diameter, 1¼" long with a ⅝" hole and have trouble with the porosity on the inside of the billet to which the gate is attached. The mixture we are using is 58 copper, 2½ lead, 39½ zinc and one ounce of aluminum to 100 pounds of metal. We have changed our gating several times as we felt possibly the pitting was due to shrinkage. Could you recommend any flux that would help out in pouring the mixture?

A.—We do not know of any flux that will help in pouring such a mixture, as lead and aluminum in such a mixture produces porosity.

If they will reduce the lead to ½ per cent or less you will have very little trouble with such a mixture. We are of the opinion that a mixture containing aluminum and lead will give more or less trouble at all times.

We suggest that you eliminate the lead, if possible, and a strong casting will be obtained, free from porosity.—W. J. R. Problem 3,176.

METAL ON CELLULOID

Q.—Would kindly ask you if you would give us any information on the putting of silver or nickel deposit on a celluloid surface. We would also like to know which of these is cheaper, as it must be done in the cheapest and quickest way. If you are not able to give us this information, will you kindly tell us, if you can, just where we get this information?

A.—The deposition of nickel or silver upon celluloid is not a cheap method. Briefly mentioned the method consists of outlining the design with an acetone-gun cotton lacquer mixed with platers' copper bronze powder. When perfectly dry copper wire or small gauge is so arranged that it will support the celluloid article while plating and be in constant contact with the outline to be plated. Following the painting and wiring as outlined, the articles should be plated in a copper sulphate solution composed as follows:

Water	1 gallon
Copper Sulphate	1¾ lbs.
Sulphuric Acid	4 ozs.
Powdered Alum	1 oz.

The solution should preferably be agitated by air pressure. Voltage 1, temperature normal.

After copper plating for a period of time, say not less than two to four hours, the articles should be removed, washed and dried, and then lightly polish, preferably sand-buffed.

After the copper deposit is secured, the surface can be nickeled or silver plated as desired.

There are a number of other methods that can be used. In silver plating wooden cane heads, very finely powdered silver mixed with a drying oil or varnish is used as a silver paint. When this become dry and hard, silver plating is done directly.

A perusal of the chapter on Galvanoplasty or Deposition of Metal upon Non-Metallic Articles in Langbein's 8th Edition of The Electro-Deposition of Metals, will give you additional data upon the subject.

In an article published in THE METAL INDUSTRY in July, 1909, page 241, entitled the Silver Ornamentation of Fountain Pens, by George B. Hogaboom, a method is given in detail which could be used for celluloid.—C. H. P. Problem 3,177.

MOLD FACINGS

Q.—We have been experiencing considerable difficulty in removing the sand and scale from casting, copper 80 per cent, tin 10 per cent, and lead 10 per cent. The sand sticks to these castings and dulls our tools in machining. We have tried various methods of pickling but without eliminating the difficulty entirely. What would you suggest?

A.—The best method is to make the casting so that the metal will not eat in. This can be accomplished by making a facing of 20 parts of molding sand and 1 part of pitch core binder and dust the mold with a good grade of black lead; and as to the core, if you use dry sand cores, make a mixture of black lead and gasoline and mix to a consistency of dough and rub it into the core, and you will find that your castings will be smooth both inside and out.—W. J. R. Problem 3,178.

PARSON'S WHITE BRONZE

Q.—What is the composition of Parson's White Bronze?

A.—Parson's White Bronze consists of:

Copper	2%
Zinc	35%
Tin	63%
Aluminum	¼%

Horse Head zinc is used in making this mixture.—W. J. R. Problem 3,179.

RECOVERING ZINC

Q.—I have on hand a quantity of chips of an alloy, the base of which is zinc. These chips are quite fine and I would like to remelt same with the least loss. Will you kindly advise me of a good method to use? The equipment available for this work is the ordinary open type cast iron pot melting furnace. I might say that I have experimented a little with this material and have recovered about 50 per cent. I found that if I got the material too hot the zinc would burn up; that is after I had fluxed same with sal ammoniac. I have tried poking the chips under a bath of metal, keeping all fairly cool, and fluxing, but the work is slow, and losses over 50 per cent. I have also tried a heavy layer of charcoal over the chips and kept the air off the surface of the charcoal, but without any good results.

A.—The best method of handling such material that we know of is to reduce them in a retort similar to what is used for refining zinc drosses. The zinc passes off in the form of vapor, condenses as it issues from a properly formed channel and flows into the molds placed to receive it. The process is, therefore, one of distillation.

The flux used is coal mixed sweepings or chips, 10 per cent coal dust. You say your method is to use an iron pot. The only way to reduce the loss is to keep the metal covered with sal ammoniac. Gray sal ammoniac is best—similar to what is used in galvanizing. Do not let the zinc get overheated and puddle the chips into the bath a little at a time. We note you do poke the chips under the bath and that the process is slow and the loss still high. This is the only method that can be used with an open cast iron pot. The retort furnace is the proper furnace for this work and this process gives you a very fine grade of spelter.—W. J. R. Problem 3,180.

ROUGH SURFACE ON INGOTS

Q.—We are making ingot composition in an air furnace. We find that our ingot metal surface is very rough. We use plenty charcoal on the metal during the melting but find it helps very little. We would like to know what flux would make a smooth surface.

A.—The practice in use in making ingots where a smooth surface is desired is to cover the ingot mold with a hard wood board, leaving an opening just large enough to allow pouring. This will give a very nice surface on the ingot but this method is rather expensive. The common practice is to skim the ingot as soon as poured, which gives very good results, but not as good as the ingot covered with the piece of wood. No flux is necessary.—W. J. R. Problem 3,181.

SPOTTED COPPER PLATE

Q.—Will you please advise me what causes brass spots to appear in copper plating steel? We copper plate all steel about 15 minutes and then nickel plate. It is necessary to have a clear deposit. I add potassium cyanide and about 1 oz. of hyposulphite of soda to a 70 gallon solution. This gives a clear deposit for a few days only. In that time I can run about 4 batches. This solution was made up of: water, 1 gallon; copper carbonate, 5 ozs., potassium carbonate, 2 ozs.; potassium cyanide, 10 ozs.

A.—Brass spots cannot result from a copper solution unless zinc in some manner has been added to the solution. It is possible that your copper carbonate is contaminated with zinc carbonate to some extent. To avoid such a condition, why not use pure copper cyanide? The zinc will work out if your copper solution is used warm, in a short time. Omit the use of hyposulphite of soda and in its place use bisulphite of soda. This material can be used up to two ozs. per gallon of solution providing the solution contains sufficient free cyanide. It is a reducing, conducting and brightening agent and is the best all around additional agent that can be added to copper bronze or brass solutions. To show the effectiveness of copper cyanide for plating solutions, your formula could have been duplicated as follows, based upon the 5 oz. copper carbonate you used.

Water	1 gallon
Sodium Cyanide	4¼ oz.
Copper Cyanide	3½ oz.
Bicarbonate of Soda	2 oz.
Hyposulphite of Soda	1/64 oz.

A reduction of 50% in weight of materials per gallon and 25% in cost.—C. H. P. Problem 3,182.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,426,110. August 15, 1922. **Process of and Apparatus for Pouring Metal.** Daniel J. Ryan and Louis J. Feltes of Cleveland, Ohio.

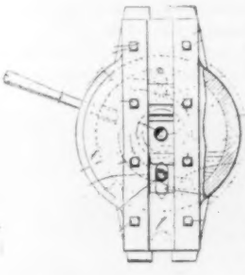
This invention relates to process of and apparatus for pouring molten metal into molds.

One object of the invention is to provide an improved pouring apparatus adapted to prevent slag and foreign matter from entering the mold cavity.

1,429,537. September 19, 1922. **Air Brush.** Werner F. Rothermund, Brooklyn, N. Y.

This invention relates to air brushes and more particularly to the type of air brushes which are adapted to apply lacquers, varnishes, etc., by the use of compressed air.

1,435,035. November 7, 1922. **Double-Motion Cam Device.** Adolph A. Walroden, Norwich, Conn.



In a device of the class described, the combination of a bed plate, a cap plate provided with an inner and outer annular flange resting upon the bed plate, the inner flange engaging the inner portion of the bed plate and the outer flange engaging the outer face of the bed plate, said cap plate provided with a pair of ledges and a groove formed between said ledges, jaws slidably mounted in said groove, and cam means positioned between the bed plate and the cap plate and operably connected to the jaws for adjusting the jaws in the groove when said cam means is operated.

1,436,247. November 21, 1922. **Heating Metal Pot.** George J. Hagan, Pittsburgh, Pa.

The combination of a melting pot, a furnace for the combustion of fuel whereby the metal in the pot is raised approximately to the desired temperature and an automatically controlled heater for maintaining the metal at the desired temperature.

1,437,003. November 28, 1922. **Electroplating Apparatus and Process.** John J. Mueller, Ottawa, Ill., assignor to American Nickeloid Company, Peru, Ill.

A machine for continuously electroplating metal strips comprising a tank, anode plates in said tank, a suitable source of electrocurrent the negative side of which is connected to the ends of said strip extending out of said tank and the positive to said anode plates and a rolling contact connecting the negative to said strip within the tank.

1,437,010. November 28, 1922. **Conveying and Pouring Device for Molten Metal.** Carl A. Philippi, New York, N. Y.

A conveying and pouring device comprising a ladle, supporting wheels for the ladle, means for pivotally mounting the ladle upon the wheels to support it at various elevations, and means pivotally connected with the ladle for tilting it on its pivot.

1,437,316. November 28, 1922. **Method of Making a Lead-Coated Copper Sheeting.** Adolph Klein, New York, N. Y.

The method of producing lead-coated copper sheeting, which comprises mangling the copper to produce an uneven, irregular surface thereon, treating the copper surface with a cleansing agent, passing the copper surface through a lead bath and then treating the lead surface with an oxidizing agent after it has cooled.

1,437,405. December 5, 1922. **Method and Means of Treating Molten Metal.** Frank L. Driver, Jr., Newark, N. J., assignor to Driver-Harris Company, Harrison, N. J.

In the process of treating molten alloys adapted to be cleansed by magnesium, the improvement which consists in alloying magnesium with a heavier metal, the magnesium being approximately fifty per cent of the resultant product, and combining the resultant product with the molten alloy.

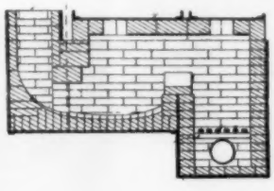
1,437,641. December 5, 1922. **Solder for Aluminum and Its Alloys.** Gustave Ferriere and Siegfried Pfyffer, Zurich, Switzerland; said Ferriere assignor to said Pfyffer.

A solder for aluminum and its alloys, consisting of four metals in the following proportions: 85-95% of tin, 0.5-9.5% of zinc, 0.5-4.5% of silver and 0.5-4.5% of copper.

1,437,507. December 5, 1922. **Electrode.** Colin G. Fink, Yonkers, N. Y., assignor to Chile Exploration Company, New York.

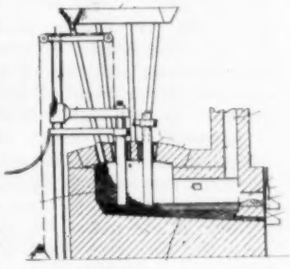
This invention relates to an improved electrode of particular value for use as an anode in the electro-deposition of copper from copper sulfate electrolytes, but available for use for other purposes.

1,438,342. December 12, 1922. **Reverberatory Furnace.** Wenzeslaw Frank Sklenar, London, England.



This invention relates to a new or improved reverberatory furnace of the fusion or melting type and has for its primary object the production of a highly efficient furnace which may in some cases be readily moved from place to place as required, is inexpensive to construct, and operate, and is economical in fuel.

1,438,381. December 12, 1922. **Electric Reverberatory Furnace.** Robert M. Keeney, Denver, Colo.



This invention relates to furnaces for smelting ores and other materials, and its primary object is to provide an electric reverberatory furnace in which an electric current is caused to pass through an automatically maintained shallow bed of fresh material in a closed smelting chamber for the generation of heat of the very high temperature essential to the rapid and complete reduction of refractory ores and concentrates.

1,438,722. December 12, 1922. **Electrolytic Anode.** Ralph Arthur Price, Berwyn, Ill., assignor to Western Electric Company, Inc., New York.

This invention relates to electrolytic anodes, and more particularly to anodes of such metals as zinc, etc.

The object of this invention is to provide a construction of anode hook and suspending bar which reduces to a minimum the tendency toward a high resistance contact between such members due to the accumulation of salts between their contacting surfaces.

1,438,999. December 19, 1922. **Torch for Melting Precious Metals.** Sam W. Hoke, Palisade, N. J.

These improvements relate to the torches, so called, used by jewelers and others for the reduction of gold, platinum, iridium, palladium, and other precious metals, and for fusing silica, and for other purposes where high temperatures and accurate and facile control are desirable.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

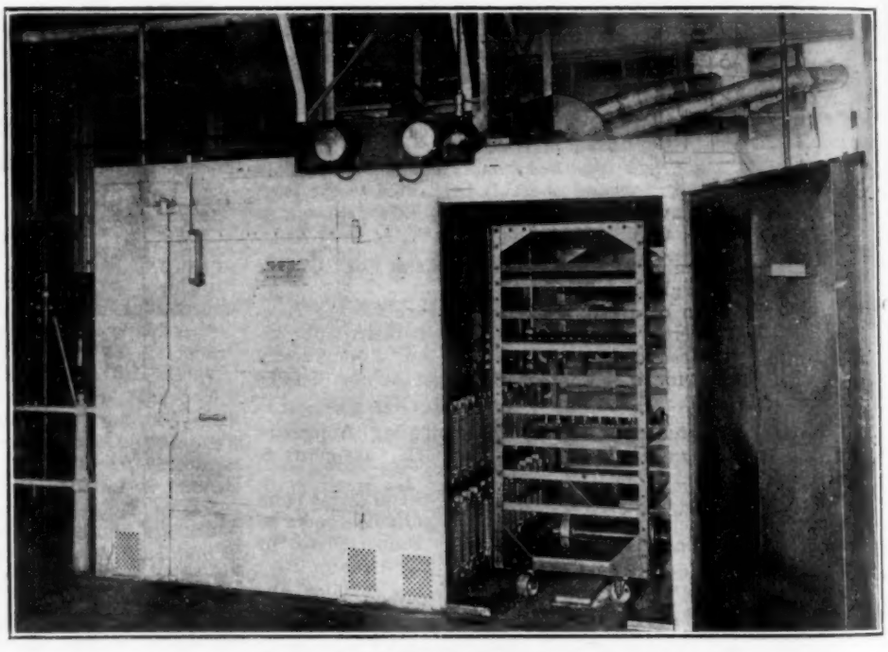
Electric Japanning Ovens

Installation of Bausch and Lomb Optical Company, Rochester, N. Y.

The Bausch and Lomb Optical Company, of Rochester, N. Y., have installed two batteries of electrically heated japanning ovens that are interesting, both because of the character of the work done in them, and the results that have obtained with them. The material baked comprises not only high grade japan, but rubber enamels and bakelite, and the finished parts are used in the assembly of microscopes, field glasses, and other instruments where the quality of the finish is of paramount importance. The effect of electric heat on the quality of the finished articles, and upon the overall production cost, under these exacting conditions should be of interest to those with similar problems to overcome. Since the ovens have been installed, it is stated that the percentage of parts rejected because of improper baking has been reduced to about 40 per cent of the total amount baked, as compared to about 50 per cent with the gas ovens formerly used for the same purpose.

The total installation of ovens comprises two truck type and three shelf type, both types having a connected load of 36 kw. each in heaters, or a total of 180 kw. at 230 volts, 3 phase, 60 cycles. Since the arrangement of the heaters, and the general construction of the two types differ, they will be considered separately.

The two box type ovens are installed in one end of a small room, the rest of which contains the spray hoods, trucks, etc. The ovens are each 5 feet wide, by 6½ deep, by 6¾ feet high. They are of the box type built by Young Brothers of Detroit. The heaters are installed in two banks, on each side of the ovens, extending from front to back, about halfway up the walls. The control is automatic, by means of Tycos thermometers, and a General Electric automatic control panel for each oven. The two control panels are installed together at one end of the ovens, and carry the necessary contactors, pilot lights, overload relays, and a double-pole, double-throw switch on each panel for changing the heater connections to obtain high or low heat. The temperature range is between 300 and 450° F.



ELECTRIC JAPANNING OVEN

The shelf type ovens are mounted along the side wall of another room, which is also used as a spraying room. The baking space of these ovens are each 3 feet 4 inches wide by 2 feet 5 inches high by 3 feet deep. The heaters are installed between the bottom of the lower baking compartment and the floor level of the room. These ovens are also automatically controlled, by means of Tycos instruments and General Electric Company automatic control panels, the panel for each oven being mounted directly above the oven itself, while the instruments are mounted on the rear of the ovens.

The most interesting feature of the installation, however, is the effect the ovens have had upon production, both as regards economy, and volume. It has been stated that the parts must have an exceptionally high quality of finish, owing to the uses to which they are put. This may be elaborated by saying that these finishes must be duplicated time after time, on a large number of different parts, as these are baked in large numbers and then returned to stock, for assembly later. The effect of a number of parts with varying degrees of finish assembled together on the same microscope, for instance, need not be emphasized. The ability to control the temperature of the ovens accurately makes this duplication of results possible, as the degree of finish is determined by the temperature of baking. Furthermore, the absence of contaminating gases in the oven interior is an important factor in decreasing spoilage.

This same freedom from contamination, which extends to the atmosphere surrounding the ovens makes it possible to put the spraying machines in the same room, which naturally saves much time and labor in handling the material to be baked. The time of baking per load has been reduced from about 5 hours with gas ovens to about 1½ hours, at temperatures of from 300° to 450° F., according to the finish desired, with the electric. To sum up the matter, it is claimed that the economy of the electric oven has been found to exceed that of the gas oven because of fewer rejections, greater speed in baking, and the saving in space, labor and material that can be directly traced to the use of the electric oven.

SEYMORITE

Somewhat over a year ago, the Seymour Manufacturing Company of Seymour, Conn., adopted the trade name "Silvore" for their nickel silver of a 10 per cent or greater nickel content and proceeded to advertise nationally this fact.

After a short while, a decided opposition to this trade name developed in the silverware and jewelry trades, the contention being, that the word "Silvore" was a colorable imitation of Silver and would be dangerous in the hands of unscrupulous manufacturers or dealers.

After a friendly discussion, and after having made a survey of a large number of retail jewelers and of manufacturers, the Sey-

mour Company became convinced that the majority sentiment was against the term which they had selected.

Thereupon, they voluntarily agreed to discontinue its use and announced a contest for a replacement name.

This contest was carried on in The Saturday Evening Post and as a result, they received approximately 9,000 replies which were submitted to a representative committee of judges who selected the word "Seymorite" as descriptive of the metal and yet, not in anyway to be construed as a colorable imitation of a precious metal.

This new brand name is now in process of being trade marked and the Seymour Company entirely concur in the opinion of the judges, that it is a suitable name for those grades of Seymour nickel silver having a nickel content of 10 per cent or over.

FUEL OIL HEATING OF FACTORIES

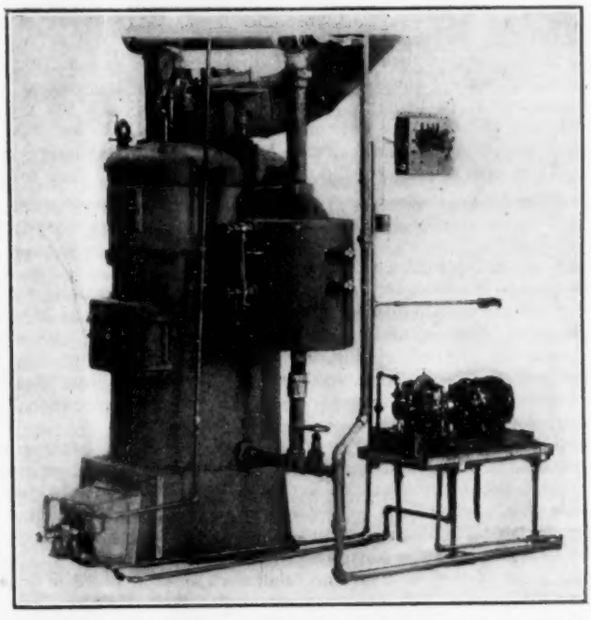
The difficulty in securing coal for the past several years has turned the attention of manufacturers to the possibility of using some other method of heating and so there has appeared a wide demand for fuel oil burning outfits, both large and small.

Outfits of this kind have been in use for many years in large plants and on steamships, it is only within the last year or two that the matter has been taken up earnestly with the idea of installing them in place of coal burning outfits. This new attention has resulted in experimentation on the part of a great many manufacturers with the result that there are now on the market many very efficient fuel oil burners. The best of them require a pump to feed the oil and a blower to furnish a blast of air to spray the oil at the burner.

A new oil-burning unit put out by Leiman Brothers, 60-62 Lispenard street, New York, is equipped with an oil and air pump and motor combined in a power unit which makes a very compact outfit. It may be attached to any sort of a furnace burning any sort of fuel at the present time and used in connection with any sort of an oil burner or any sort of an oil burning outfit. They manufacture not only these power units but the separate oil pumps and air pumps. They do not, however, manufacture the complete oil burning outfits but supply these parts to manufacturers of burners and to others who install the complete outfits as a business.

Great difficulty has been experienced in the past with pumps installed in homes where they are not in a position to receive expert attention, due to the fact that the oiling problem has not received the attention it should. Leiman Brothers has, therefore, devised an oiling system which, it is claimed, practically takes care of itself. If the oil supply should run out, the householder is immediately notified automatically so that there is no chance of the pumps running dry and causing damage.

The air pumps, in some sizes, are made to run directly on the shaft of the motor at speeds around 1,700 or 1,800 r.p.m. and the oil pump is connected on to the same shaft. Larger size air pumps are run by belt from the motor with a belt tightener device. The oil pump, in this case, is attached to the shaft of the air pump in the same way as in the outfit shown.



FURNACE EQUIPPED WITH LEIMAN OIL-BURNING UNIT

RUST REMOVER

Concerns engaged in the handling of metals or metal products, will no doubt be interested to learn of a new preparation, a foreign invention, which, at the present time, is being widely used in Great Britain and on the Continent, for the removal of rust or corrosion on all metals. It is also of considerable value to mills that maintain sulphuric acid baths for pickling purposes.

For cleaning metals or metal parts of rust or corrosion one part of the preparation to twenty-five parts water is said to be sufficiently effective to loosen and remove any rust, regardless of its age or condition. No scraping or rubbing is required, therefore the cleaning process is accomplished entirely without labor or mechanical means of any kind. Another great advantage claimed for this preparation, in contrast to all other chemical processes for removing rust is that it does not attack nor consume any of the metal itself as its action is entirely confined to the removal of rust and corrosion only. Plants using pickling baths of either sulphuric acid or hydrochloric acid, it is claimed, will find that by adding a small percentage of this preparation to either bath, it prevents the formation of hydrogen which it is now generally believed, is the cause of pickling brittleness in steel. It is stated that the addition of this preparation to the bath will save approximately fifty per cent of the sulphuric acid used, and it will neutralize the action of the bath in consuming the metal which has been freed from scale. This preparation is now available to the American market through the distributors, Peter A. Frasse & Company, Inc., 417 Canal street, New York City.

BAUSH DURALUMIN

Baush Metal-Duralumin is an aluminum alloy, which has the strength of mild steel, with a two-thirds saving in weight for sections of the same size. At the Metals Division Plant of the Baush Machine Tool Company in Springfield, Mass., it is rolled, forged, fabricated and heat treated the same as steel and the product is used for a large variety of purposes. During the recent development of Baush Metal-Duralumin in the United States, applications have been found for its use in over one hundred different industries, and there is hardly a place where iron, brass, steel or copper is used that does not have at the same time economic openings for the use of Baush Duralumin.

The Baush Machine Tool Company's exhibit at the New York National Automobile Show showed connecting rods made of Baush Metal, such as are now being adopted by various manufacturers of automobiles, also demountable rims, timing gears, etc. The use of Baush Metal connecting rods is said to have a remarkable effect in the reduction of vibration and increase of motor power; demountable rims used on automobile wheels save from 40 to 80 pounds of weight per set, improves riding comfort, facilitates tire changing, because of non-rusting qualities, makes driving easier and prolongs tire life. The metal is especially adapted for use in reciprocating and moving parts and promises in the near future to be as widely known and used as steel, brass or copper.

The Baush Machine Tool Company's exhibit was of particular interest to all manufacturers, engineers and others looking toward greater efficiency and economic value for their product.

ASSOCIATIONS and SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN FOUNDRYMEN'S ASSOCIATION

Headquarters, 140 South Dearborn Street, Chicago, Ill.

Due to rearrangements certain changes have been made in the layout of the Foundry Exhibit in Cleveland, April 28—May 3, 1923. Some changes will be necessary in the layout on the stage, but this will be of interest to only those who occupy stage space.

If the changes on the Arena floor affect the choice of any exhibitors, it is asked that they kindly notify the secretary at once.

Demand for space has been unusually heavy and if any exhibitors can see their way clear to reduce the amount of space specified in their applications, it would be greatly appreciated. The management particularly wants to take care of all the old exhibitors and as many new ones as can be provided for. To this end they earnestly desire the co-operation of the exhibitors.

They wish to urge exhibitors, as has been their custom, to make mention in all trade paper advertising of the fact that they will exhibit at the convention. It is not necessary to mention booth numbers, and the management cannot see that there is any particular advantage in doing so, as visitors locate exhibitors by the booths signs rather than by numbers.

The management will proceed as rapidly as possible in making assignments, which they are sure all appreciate, is a difficult task. If it were possible to give each his first choice of location, they would be very happy indeed, but it is impossible to place more than one exhibitor on the same space. They will do the very best they can for all and trust that all will be satisfied. The Committee on Exhibits has placed on the managers the responsibility of making assignments, but this will not be done in any arbitrary way.

METAL FINISHERS' EXPOSITION

By M. G. Kopf, Director

One of the most far reaching and conspicuous events in the history of the metal finishing industry will take place in the Memorial Building, Dayton, Ohio, on April 9 to 14th inclusive, and will be known as the Metal Finishers' Exposition. The project was originated and is being fostered by the Dayton branch of The American Electro-Platers Society. It is purely educational and not profit making.

There have been many expositions in which finishes naturally assumed an important part, but this importance was never emphasized. For instance, at an automobile show comment is had on glass-like surfaces and color combination, but the automobile is the attraction. The dealer nor the public has the slightest appreciation or knowledge of the processes, equipment and materials as well as the great amount of labor and relative expense involved in producing the finishes, yet manufacturer, dealer and public realize from a sales standpoint that the finish creates the necessary first favorable impression and final confidence in the product.

The Metal Finishers' Exposition at Dayton represents the first organized effort to acquaint and educate the general public, who represent the ultimate consumer and who demand superior finishes, with the details and processes involved in producing these finishes.

In selecting and arranging the exhibits a logical plan is being followed in order to present in an orderly manner the steps in handling products in the finishing process. Raw materials, equipment and processes will be shown and finally the application on the finished article. In many cases, working demonstrations will be made. For instance, a paint manufacturer will show a grinding mill in operation, and the local branch of the A. E. S. will have a complete plating plant in operation. A new process of photographically producing wood finishes on metal will be shown in actual operation. Souvenirs will be finished in the booths for distribution. A number of new products, equipment and materials will be shown for the first time.

As a feature attraction, popular lectures on various finishing subjects are being arranged for. These will be held in the afternoon and evening. Certain days will be set aside for particular purposes. Ladies' Day will feature household appliances and invitations will be extended to the various Womens' organizations in Dayton and surrounding cities. On School Day special lectures and demonstrations will be given in order to teach the young the importance of finishes and what is involved in their production. Merchants' Day will bring out the relation of finish to sales, educating them on the question of costs through a better understanding of the materials, equipment and labor involved in producing finishes.

The purpose of the exposition may be described as follows:

1st. To acquaint the buying public with the various methods and the many phases of the metal finishing business, necessary to produce the decorative and protective finishes which they consider so essential on all products.

2nd. To acquaint the manufacturer and dealer of these products with the many materials, processes and equipment necessary to produce finishes, and to demonstrate their application and use.

The original investigation as well as the actual taking of space by the trade met with instant enthusiastic response. It has been very gratifying to the originators to discover those in the metal finishing business who are anxious to give their support to this project and who coincided with the broad vision and possibilities involved. The following exhibitors have been selected to demonstrate and emphasize certain steps in the finishing of various nationally known products. These represent the first weeks response and up to present writing. The booth numbers appear before the name.

1. Dayton Plating & Manufacturing Company.
3. Mitchell Eng. Company.
6. National Cash Register Company.
7. Egyptian Lacquer Manufacturing Company.
8. Kay and Ess Paint Company.
9. Dayton Scale Company.
12. Dayton Air Brush Company.
13. (a) Homan Plating Company.
13. (b) Magnus Chemical Company.
14. American Display Company.
16. American Electric Platers Society.
17. American Rolling Mill Company.
18. Thos. Buchanan Company.
19. J. B. Ford Company.
20. (a) Udylite Company.
20. (b) Forest Hartzell.
24. Waukegan Chemical Company.
25. Hill & Griffith Company.
26. R. F. Johnston Paint Company.
28. American Cities Service Corporation.

Every member of the branch, as well as the neighboring branches, is actively engaged in furthering the success of this project. Civic organizations are likewise assisting and judging from the efforts put forth the city of Dayton will add still another new one to its already long list of original ideas. Following are the names of the members of the Exposition committee: M. G. Kopf, Chairman, W. Fraine, Sec., H. J. Harter, J. I. Pace and A. Lamoureux.

The following program will be carried out:
Monday, April 9, Opening Day.
Tuesday, April 10, Industrial Day.
Wednesday, April 11, Ladies' Day.
Thursday, April 12, School Day.
Friday, April 13, Dealers' Day.
Saturday, April 14, A. E. S. and Banquet.

The following lecture program will be carried out—twice daily.

MONDAY EVENING

Opening Address—C. F. Kettering, Vice-President and Chief Engineer, General Motors Corporation.

Finish and Sales—C. E. Steffey, Sales Manager, National Cash Register Company.

TUESDAY

Raw Materials—D. M. Strickland, Research Engineer, American Rolling Mill Company.

WEDNESDAY

Finishes for the Home—Theo. Pond, Director Dayton Museum of Art.

THURSDAY

Plated Finishes—Dr. Wm. Blum, U. S. Bureau of Standards.

FRIDAY

Enameled Finishes—H. F. Kitteredge, Vice-President, Kay & Ess Paint Company.

SATURDAY

Address of Welcome to Visiting A. E. S. Members—M. G. Kopf, Director of Exposition.

Response—W. J. Allen, National President of A. E. S.

The local branch is offering a substantial prize to the members of the Art Museum under the guidance of its Director for the best poster design. The posters will be symbolic of the Metal Finisher and will be done by hand according to a new process on art-craft paper.

AMERICAN ELECTRO-PLATERS' SOCIETY

CHICAGO BRANCH

Headquarters, care of F. J. Hanlon, 2921 George Street

On January 19, 1923 the Chicago Branch held its Eleventh Annual Banquet at the Elk's Club. Speakers were W. J. Allen, Supreme President; W. G. Bott, R. J. Hazucha, Dr. O. P. Watts, E. G. Louering of Detroit and representatives from St. Louis, Grand Rapids, Indianapolis, Milwaukee and Philadelphia. Branches in all, 211 men sat down to an excellent repast and were entertained by the Apollo Quartette and community singing.

The committee in charge consisted of E. Lamonreaux, chairman; R. J. Hazucha, O. E. Servis, F. J. Liscomb, W. G. Meggers, M. P. Hunter, H. A. Gilbertson, C. E. Thornton and Vice-President Emmett.

CONNECTICUT VALLEY BRANCH

Headquarters, care of Tennant Elmin, Newington, Conn.

The Connecticut Valley Branch meets on the fourth Monday in each month at 747 Main Street, Hartford, Conn.

PITTSBURGH BRANCH

Headquarters, care of S. E. Hedden, 227 Fifth Ave., Aspinwall, Pa.

While Pittsburgh Branch American Electro Platers' Society is one of the youngest branches of this educational society in existence, it is surely not in the background when it comes to showing its members and friends a good time in a novel and entertaining way.

This year marks the fourth milestone in the career of Pittsburgh Branch. In celebration of this, some of the charter members thought it would be a mighty good thing for the active charter members who are still in the Pittsburgh district to act hosts to all the other members who have joined since the formation of this branch in 1919 at a party or reception probably the first week in April.

Not only are the members invited to this celebration, but they are requested to bring their wives, daughters, sisters and sweethearts. Likewise any member of this Society is also extended a cordial invitation to attend this affair which will be complimentary in honor of the members of Pittsburgh Branch.

Dancing and moving pictures will be the features of the good time planned, and of course, no mention need be made of the "eats" which will be the headliner on the program.

The Pittsburgh Bureau of Mines had been the location planned for this affair by the committee in charge but as this is Government property it was later learned that it could not be held Saturday night, April 7th—the date likewise planned.

Hope has not been given up, however, of still holding this affair in the Bureau of Mines. When definitely arranged the date will be announced by the Publicity Committee.

The committee in charge of this "gala time" is as follows:—Jos. E. Weigand, president; S. E. Hedden, secretary; John Corbit, moving pictures; Herman Peter, lunch and music; Chas. J. Rothfuss, dancing; Wilfred S. McKeon, publicity; Elliott S. Corbit, ex officio.

BRITISH INSTITUTE OF METALS

Headquarters, 36 Victoria Street, London, S. W. 1, England

At the Annual General Meeting of the Institute of Metals held in London, England, March 7-8, 1923, the following communications were expected to be submitted:—

AITCHISON, D. "The Mechanical Properties of the Magnesium Alloys."

AUSTIN, C. R., and A. J. MURPHY. "The Ternary System Copper-Aluminum-Nickel."

BECKINSALE, S. "Further Studies in Season-Cracking and its Prevention. The Removal of Internal Stress in 60:40 Brass."

BELAIEW, Colonel N. T. "The Inner Structure of the Crystal Grain as Revealed by Meteorites and Widmanstätten Figures."

BINGHAM, Kathleen E., and J. L. HAUGHTON. "The Constitution of Some Alloys of Aluminium with Copper and Nickel."

CARPENTER, Professor H. C. H., and C. COLDRON SMITH. "Tests on Work-Hardened Aluminium Sheet."

COOK, Maurice. "The Recrystallization of Cold Worked Cadmium."

GAYLER, Marie L. V., "The Constitution and Age-Hardening of the Ternary Alloys of Aluminium with Magnesium and Copper."

GENDERS, R. NOTE:—"The Extrusion Defect in Brass Rods Extruded from a Multiple Die."

GENDERS, R. NOTE:—"The Scleroscope Hardness Test. A New Form of Magnifier Hammer."

GRAY, Arthur W. "Volume Changes Accompanying Solution, Chemical Combination, and Crystallization in Amalgams."

HANSON D., and Marie L. V. GAYLER. "The Heat-Treatment and Mechanical Properties of Alloys of Aluminium with Small Percentages of Copper."

HEAPE, Harold. "The Density and the Hardness of the Cast Alloys of Copper with Tin."

LEA, Professor F. C., V. A. COLLINS, and E. A. F. REEVE. "The Modulus of Direct Elasticity of Cold-Drawn Metals as a Function of Annealing Temperature."

NORBURY, A. L. "The Hardness of Annealed Copper."

NORBURY, A. L. "The Hardness of Certain Copper Alpha-Solid Solutions."

PILLING, N. B., and R. E. BEDWORTH. "The "Oxidation of Metals at High Temperatures."

PORTEVIN, A. M. "The Structure of Eutectics."

READER, R. C. "Some Properties of the Copper-Rich Copper-Aluminium Alloys."

ROSENHAIN, W., S. L. ARCHBUTT, and S. A. E. WELLS. "The Production and Heat-Treatment of Chill Castings in an Aluminium Alloy ('Y')."

MAY LECTURE

After the Annual General Meeting the next gathering of Members will take place, as previously announced, on Wednesday, May 2, at the Institution of Mechanical Engineers, at 8 P. M., when Dr. W. Rosenhain, F. R. S., will deliver the Annual May Lecture, his subject being "The Inner Structure of Alloys."

Personals

Ralph **L. Glaser** has been made New England district manager of the Warner & Swasey Company, machine tools, to succeed the late H. L. Kinsley.

O. P. **Hatton** has joined the organization of the Bridgeport Brass Company, Bridgeport, Conn., in the capacity of publicity manager. Mr. Hatton has had considerable experience in technical advertising, having specialized in this line for the past ten or twelve years.

W. B. Jones has been made district manager of the Lyon Metallic Manufacturing Company, Boston, Mass. He was formerly resident engineer for the Robins Conveying Belt Company.

W. A. Graue, of the Magnus Chemical Company, Brooklyn, N. Y., gave a talk on Industrial Cleaners before the Waterbury Branch, American Electro-Platers' Society, February 23, 1923.

E. R. Ritter is now associated with the Cincinnati Aluminum Casting Company, Cincinnati, Ohio, as secretary-treasurer in charge of manufacture. He was formerly president of the Hill & Griffiths Company, Cincinnati.

A. F. Saunders, designer of silverware, who is well known to METAL INDUSTRY readers as the author of a long series of articles on the art of designing, has recently undergone an operation at Battle Creek Sanitarium, Battle Creek, Mich. He has recovered and is now at his desk again where he is designing a new line of silverware and art metal novelties for the Benedict Manufacturing Company, East Syracuse, N. Y.

Dr. Walter Rosenhain, F. R. S., the eminent English scientist, gave two brilliant lectures at Carnegie Institute of Technology, Pittsburgh, Pa., on February 12th and 13th, according to a report from the institution. As both lectures were held in the evening and were public hundreds of scientific and engineering men of Pittsburgh took advantage of the opportunity to hear him, and on both occasions he was greeted by enthusiastic and representative audiences. The subject of his first address was "Metallurgical Research at the National Physical Laboratory, Teddington, England," of which he is superintendent. In the second he discussed "Strain, and its Relations to Fractures of Metals."

J. R. Egan, a well known foreman plater of New York has accepted a position as representative of the Tri-Solvent Company, 526 West 34th Street, New York City, manufacturers of a metal cleaner known as Tri-Solvent.

W. H. Barr, president of the Lumen Bearing Company, Buffalo, N. Y., and president of the National Founders' Association, Chicago, Ill., has been appointed on the Advisory Committee of the American Engineering Standards Committee, 29 West 39th street, N. Y.

Cloyd M. Chapman has become affiliated with Dwight P. Robinson & Company, Incorporated, as Consulting Materials Engineer. Mr. Chapman, who has been active in the work of the American Society of Testing Materials and the American Concrete Institute will in the future represent Dwight P. Robinson & Company in the committee work of these societies.

William A. Locke, New York resident manager for the Taunton-New Bedford Copper Company, was tendered a dinner on January 31st, at the Hotel McAlpin by his associates in the New York Office—the occasion being his retirement from commercial life owing to ill health, after an active business career of nearly half a century in metals and kindred lines. He was one of the organizers and President of the American Manganese Bronze Company of Philadelphia, severing his connections with that concern in 1915 to direct the affairs of the Taunton-New Bedford Copper Company in this city, Mr. Locke's retirement is deeply regretted by all who have had occasion to come in contact with him—who know his sterling qualities, and realize that the industry is losing a member of value whose place will be very hard to fill. He is being succeeded by Raymond A. Dusault of the home office of the company.

Deaths

DUDLEY A. JOHNSON

Dudley A. Johnson, late manager of the Chicago Sales District of the Joseph Dixon Crucible Company, died on Friday, January 26, 1923, at Miami, Florida. He had not been well for some time past and was at Miami in an endeavor to regain his health.

DUDLEY A. JOHNSON

Mr. Johnson was born at New Albany, Indiana, in 1867. He moved to Chicago and secured a position with the stationery house of Brown, Pettibone & Kelly. In 1897 he resigned as manager of the stationery department of that firm, to become Western representative of the Holyoke Envelope Company. The following year he formed a connection with the Dixon Company, taking charge of the lead pencil and school work in the Chicago territory. Later he assumed charge of the crucible and graphite productions.

The introduction of liquid brazing in the bicycle trade was largely due to his efforts. Today this method is in use wherever bicycles are made.

At the time of his death, Mr. Johnson was in charge of the Chicago Sales District, having succeeded the late Sam Mayer in 1914.

With the trade he was always popular and highly respected. Among his friends he was beloved and trusted.

JOEL CADBURY

Joel Cadbury, one of the senior members of the old Quaker firm of Haines, Jones & Cadbury Company, manufacturers and jobbers of plumbing and heating supplies of Philadelphia, Pa., died Thursday, January 25th. Mr. Cadbury's connection with the plumbing industry dates from the year 1867 and since then he had been actively engaged in various capacities up until two weeks of his death. The firm with which he has been associated was founded in 1858 primarily for the manufacture of high grade brass work. His active business life coincided, therefore, with the great growth in sanitary plumbing, and he, with his business partners, have been instrumental in developing a business undertaking from a small plant for the manufacture of plumbing material required in the early days of the industry into an organization covering a large part of the United States with a large brass works in Philadelphia, iron works, in Norristown, Pa., and branch houses at Philadelphia, Pa., Richmond, Va., Charlotte, N. C., Savannah, Ga., Jacksonville, Fla., and San Francisco, Calif.

JOSEPH S. HIBBS

On December 8th, Joseph S. Hibbs, veteran manufacturer of foundry supplies and equipment, died of pneumonia while visiting his daughter, Mrs. George W. Bahlinger, Trenton, N. J. He was 79 years of age and had been a member of the J. W. Paxson Company, Philadelphia, Pa., for 30 years. Mr. Hibbs learned the trade of stove molding with the Liebrandt & McDowell Stove Company, Philadelphia. In 1862 he enlisted in the Union Army and served throughout the civil war. Upon his discharge from the army he returned to Philadelphia and entered the foundry business on his own account. Later he accepted a position as sales manager for the S. Obermayer Company at Cincinnati. He joined the J. W. Paxson Company as sales manager and assistant general manager in direct charge of the traffic department 30 years ago. The late Mr. Hibbs was a member of the Manufacturers' Club, American Society of Mechanical Engineers, American Ceramic Society, American and Philadelphia Foundrymen's Associations, American Institute of Mining and Metallurgical Engineers, Traffic Managers Association, American Academy of Political and Social Science, Pennsylvania Academy of Fine Arts and the Pennsylvania Museum and School of Industrial Art.

GEORGE E. CAMP

George E. Camp, first president of the Waterbury Castings Company, died at his home, 117 Euclid avenue.

Waterbury, February 17, after a brief illness, at the age of 46.

He was born in Waterbury September 21, 1876, the son of Oliver Gaylord and Laura (Earner) Camp, both natives of Roxbury. After leaving college he became associated with his father, later organizing and becoming first president of the Waterbury Castings Company. He was for several years a deacon of the First Congregational Church, was prominent as a Mason and Knight Templar. He married October 9, 1904, Miss Laura M. Mitchell of Newton, who survives him with three children, Merwin G., Nelson M. and Margaret H. Camp, his mother Mrs. Laura Camp and three sisters, Mrs. Aaron Benedict and Misses Ruth E. and Olive G. Camp.—W. R. B.

DAVID ELIAS SPRAGUE

David Elias Sprague, 90 years of age, Waterville's (Conn.) oldest and most prominent citizen, died February 7, at his home after an illness of some month's duration. He was a member of the firm of Sprague & Root, which manufactured knives.

He was born in Waterville, February 8, 1833, the son of David A. and Anna (Downs) Sprague and his whole life with the exception of 11 years was spent here. He learned knife making after graduating from college, and started in a local factory at that trade. The factory failing he started in business himself, forming a partnership with Alva Miller, who was later succeeded by Samuel Root. The factory of Sprague and Root, later Sprague and Boyden for the 25 years following the Civil War was practically the only knife shop in this section. For 47 years Mr. Sprague was a director of the Citizens National Bank. W. R. B.

THEODORE MERTZ

Theodore Mertz, manufacturing jeweler, died at his home, 160 Mercer place, Tuxedo Park, South Orange, N. J., February 10, 1923, a short time after he was stricken with apoplexy.

Mr. Mertz was born in Newark in 1856. He mastered the jewelry trade working with Aaron Carter, Jr. He then went to Providence, R. I., being employed by the Gorham Company. He returned to Newark and with his brother Emile C. Mertz, established a jewelry manufacturing business, later going into business alone, doing special order platinum work, which he continued up to the time of his death.

CHARLES E. MARENTETTE

Charles E. Marentette, general sales manager of the Art Stove Company, died on Friday, December 29, 1922. He had been associated with that company for twenty years, the last fifteen as general sales manager, and was well known to the hardware, plated ware and furniture trade.

Mr. Marentette leaves a wife and four children.

JAMES N. WEBB

James N. Webb, aged 72 years, died at his home 80 Waterville Street, Waterbury, Conn., January 24, 1923. He was born in Winsted, Conn., but had spent a great portion of his life in Ansonia, coming to Waterbury some thirty years ago. He was master mechanic and superintendent of the Benedict & Burnham branch of the American Brass Company.

CUTHBERT J. SEELY

Cuthbert J. Seely of Boston, Mass., superintendent of the brass foundry of T. McAvity & Sons, Ltd., Montreal, Canada, died suddenly February 13, 1923.

DANIEL A. SKINNELL

Daniel A. Skinnell vice-president of the Skinnell Silver-plating Company, died at his home in Whitestone, L. I., February 15, 1923.

NEWS OF THE INDUSTRY

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

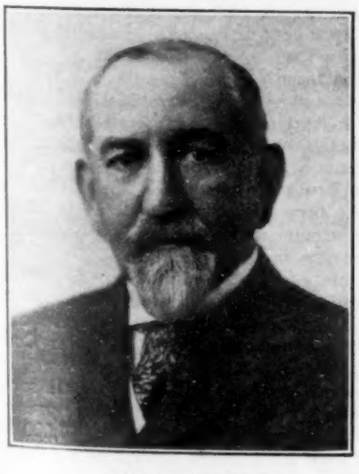
AMERICAN BRASS REORGANIZATION

MARCH 1, 1923.

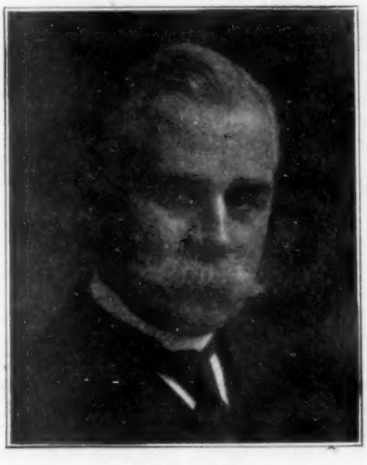
Changes in the list of executive officers of the **American Brass Company,** predicted in THE METAL INDUSTRY several months ago materialized at the company's annual meeting held last month. The four men who retire are all prominent local citizens and have been connected with the brass industry all their lives.

No new officials were elected to their positions and the offices were abolished. It is understood that the offices were more in the nature of honorary than executive positions and were created at the time the various units of the American Brass Company were brought together to afford offices for the heads of the former units composing the amalgamation. Their actual duties are said to have grown less and less and with the absorption of the Brass company by the **Anaconda Copper Mining Company** their stock interest in the company was naturally lessened.

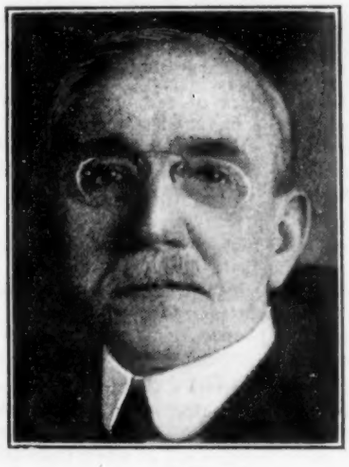
The men retired are **John P. Elton, Thomas B. Kent, Gordon W. Burnham** and **Elton S. Wayland.** John P. Elton



C. F. BROOKER
Chairman of the Board



JOHN A. COE
President



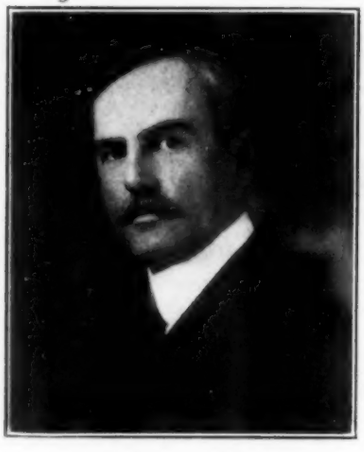
E. L. FRISBIE
Vice-President

served as vice-chairman of the board and first executive vice-president. These offices have been abolished as have the two executive vice-presidencies held by the Messrs. Kent and Burnham and the assistant secretaryship held by Mr. Wayland. **Charles F. Brooker** was re-elected chairman of the board and **John A. Coe** was re-elected president. The number of directors was also reduced from 21 to nine.

The directors elected are: **Charles F. Brooker,** Ansonia; **John D. Ryan,** New York; **Cornelius F. Kelley,** New York; **John A. Coe,** Waterbury; **Benjamin B. Thayer,** New York; **Edward L. Frisbie,** Waterbury; **Clifford F. Hollister,** Waterbury; **George H. Allen,** Buffalo; **Edmund H. Yates,** Waterbury.

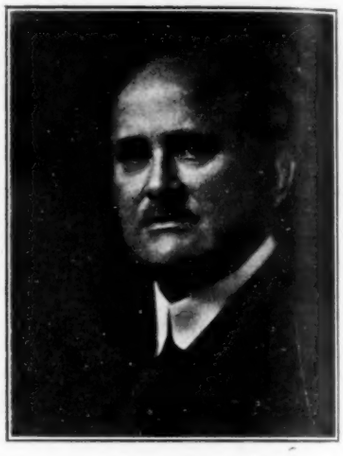
EXECUTIVE OFFICERS

Chairman of the Board, **Charles F. Brooker.**
President, **John A. Coe.**



JOHN D. RYAN
Director

C. F. KELLEY
Director



B. B. THAYER
Director

Executive Vice-president, **Edward L. Frisbie.**
Treasurer, **Clifford F. Hollister.**
Assistant Treasurer, **Major W. Judge.**
Assistant Treasurer, **S. Burnham Terry.**
Secretary, **Edmund H. Yates.**

The retiring officers and directors are as follows: Vice-Chairman, John P. Elton; executive vice-presidents, Thomas B. Kent and Gordon W. Burnham; assistant secretary, Elton S. Wayland; directors, T. Brownell Burnham, Cleveland H. Dodge, John E. Wayland, Royall Victor, Alton Farrel, Frederick L. Braman, Arthur M. Dickinson, John P. Elton, Gordon W. Burnham, Thomas B. Kent, Arthur C. James, Harris Whittemore, George H. Allen, William A. Cowles and Hiram M. Steele. Frederick L. Braman remains, however, as vice-president in charge of the Torrington Branch.

Stockholders of the **Scovill Manufacturing Company** have received the financial statement for December 31, 1922, showing the assets to have been $28,702,416.64 at the end of 1921 and to be $28,771,903.81 at the end of 1922. Land and buildings less depreciation were valued at $9,143,676.39 and machinery at $9,022,767.22.

All the factories and products of Waterbury have been listed in a little booklet just issued by the statistical department of the local Chamber of Commerce. This shows a total of over 100 factories of which over 50 manufacture either brass, copper or bronze, or articles made wholly or in part of those metals.

According to the **Chamber of Commerce** Waterbury will show the finest increase in employment in the country for the first two months of the year, its figures showing that today 475 more persons are at work than on January 1st. The figure today is 13,434 against 12,679 December 1st, the largest increase for any two months in the past year. Both local clearing house and post office report gains over the corresponding month of 1922. The total for the month at the clearing house was $7,977,100, a gain of $225,800. The post office's gain in postal receipts for the month amounted to $3,310 more than the figure for 1922 and were $3,965 over the total for 1921. The improvement in business conditions was held responsible for the increase, it was said.

William B. Price, chief chemist and metallurgist of the **Scovill Manufacturing Company,** spoke on "Application of Technical Control to the Brass Industry," before the Production Club in the Chase Company's auditorium, at the club's last meeting. "Technical control," he defined, as physical testing, chemical analysis, microscopic examination of polished and etched sections and pyrometric control of heat treatment.—W. R. B.

BRIDGEPORT, CONN.

MARCH 1, 1923.

Figures gathered by the Manufacturers' Association from 31 representative manufacturing plants in the city announced that the number of employees engaged for the week ending Feb. 17th was 18,234 or 71.7 per cent of high normal and is the best of bulletin of local industrial activity issued in two years of brass activities. At the highest peak of industrial activity during the war period it was estimated that the number employed in the 31 manufacturing plants was 25,318. After the armistice and the withdrawal of war contracts from the local manufacturing plants there was steady decrease in employment until the summer of 1921 when the number employed was 12,021 or 47.5 per cent of normal. Since then there has been a slow but steady rise.

The biggest deal of the month in Bridgeport was the sale of the dictaphone department of the **Columbia Graphophone Company** to **Swartwout & Appenzellar Brothers** of New York for a price said to be $1,000,000. The latter company is purchasing the plant for clients at present unknown, it is said.

The **Bridgeport Motor Truck Company** has entered into an agreement to purchase the former plant of the **Liberty Manufacturing Company** and intends to enter quantity production as soon as it occupies the new factory.

Final details in the sale of the former **Yost Typewriter Company** plant and location to the **Columbia Graphophone Company** were cleared away yesterday in the release of a mortgage for $20,000 given the **Remington Typewriter Company** by **John Child Ray** of Brooklyn.

Plans of **Jenkins Brothers,** makers of valves of all sorts, to increase their plant and operations to almost double present capacity, were revealed recently by the issuance of $1,000,000 of first mortgage six per cent gold bonds to finance the building operations and provide additional working capital for

the expansion. The bonds are secured by the plants of the company here and in Elizabeth which are appraised at $2,498,470. Part of the proceeds from the sale of the securities will be used for the construction of a five-story addition to the South Main street plant.

A patent suit of considerable national importance has been filed in the United States court at New Haven for the district of Connecticut by the **Remington Cash Register Company** of Ilion, N. Y., and Bridgeport, and **W. S. Gubelmann,** of Buffalo, against the **National Cash Register Company,** of Dayton, Ohio, charging infringement of three patents, issued to Mr. Gubelmann in 1915, 1920 and 1922. The plaintiffs charge that although the defendant company has been duly notified of the infringement it has continued to make use of the machines alleged to be infringements. The patentee, Mr. Gubelmann, has been working on cash registers and adding machines for over 30 years and numerous patents have been secured by him. After the war the Remington company began to branch out to other business. This included the perfection of a cash register, making use of Mr. Gubelmann's inventions. The preliminary work was done in the Remington Arms plant before it was sold to the General Electric company. Then the cash register work was moved to the big plant at Ilion.

Plans to build a $3,000,000 electric generating plant at Devon near here have been made public by the Connecticut Light and Power company. The station is to be operated by steam and the plans contemplate the use of 1,500 tons of coal a day. The capacity will be 100,000 horsepower for the three units to be constructed at first. Eventually there will be six units with 200,000 horsepower capacity. W. R. B.

TORRINGTON, CONN.

March 1, 1923.

The J. H. Graham Company, one of Torrington's newest metal product plants, has elected officers as follows: President, James H. Graham; treasurer, Joseph F. Graham; secretary, Charles E. Morehouse. The three officers comprise the board of directors. The secretary, Mr. Morehouse, was until recently engaged for many years with the Standard plant of the Torrington company.

The big new rolling mill addition at the Torrington Branch of the **American Brass Company** is now being used. Construction work has been in progress for about a year.

Frank M. Matthews, formerly treasurer of the Torrington Manufacturing company, who went to Chicago some time ago, has returned to Connecticut and plans to make his permanent home in Litchfield.

The Community Co-operative Company, formed by Torrington workers during the war emergency to bring down the price of food, has voted to retire from the grocery business. This action was taken when the annual report revealed that the company lost heavily during the past year. It has not been operated at a profit since the first year of its existence. Winding up of the grocery business was recommended by the new president, **August Raspiller,** representative of the American Brass group of employees.

Thomas W. Bryant, of the Union Hardware Company, has been elected president of the Torrington Club. E. H. Hotchkiss and Henry G. Ellis are the vice-presidents; D. Fred Hildreth, secretary, and John H. Seaton, treasurer.

The American Adjustable Chase Company, which has taken over the manufacturing rights of Ernest Karl's patents, has elected these officers: President, W. A. Burns; vice-president, Weston G. Granniss; treasurer, Charles H. Coit; and secretary, George H. Hunt. Mr. Burns is of Torrington. The other officers are of Litchfield.

Announcement has been made of the marriage in Newark, N. J., of **Curtis Hatheway,** of the Trumbull-Vanderpoel company of Banatam, and Miss Julia Howell, of Newark.

J. H. T.

NEW BRITAIN, CONN.

March 1, 1923.

New Britain manufacturers who have been interviewed by The Metal Industry on the present business situation and prospects for the immediate future were conservatively optimistic. Many of them know of no reason why business should not be good unless prices advance to such a point that consumer demand will be halted.

E. Allen Moore, chairman of the board of directors of the **Stanley Works,** said: "We see no weakness in the next few months. We are operating full time, or nearly full time, in all our plants. Operation is difficult owing to railroad hindrances. There is a tendency all along the line to raise prices, wages and everything else and the result might be a reaction like we had in 1920. Just now prices are firm and sales normal. Business should be good for the next few months anyway."

At the **Fafnir Bearing Company, E. H. Cooper,** said: "There is every indication of continued activity through the present year. The plant is working at capacity and finding a ready demand for products, especially the hanger boxes and industrial bearings. The greatest danger now is an advance in costs which would mean advancing prices and thus limit the demand. Up to the present time, the automobile makers particularly have exercised a sound policy in the matter of prices and are consequently in a strong position."

Albert F. Corbin, president of the **Union Manufacturing Company,** said: "Business is better than it was a year ago. Our business is allied with the business of the machine tool industry, which is improving." From the **American Hardware Corporation,** Secretary **George T. Kimball** noted that "business is fair and prospects good. There is no special drive and no special anxiety. The situation is comfortable." That business is now very good, is the statement from **H. H. Pease,** president of the **New Britain Machine Company.** These few statements, gathered from the representative leaders in New Britain industry reflect the actual conditions here. Business is on the up grade rather than on the decline and the outlook for a good summer and fall business is bright.

H. R. J.

ROCHESTER, N. Y.

March 1, 1923.

Business among the industries using non-ferrous metals is in a most cheerful state. Every electro-plater in Rochester is busily employed, and every brass foundry and copper plant in Rochester is working full time. The big plants about town, with but few exceptions, are working full time, and in some instances extra shifts are working overtime.

This condition has been making progress since the first of the year, and indicates that the season of 1923 in Rochester is bound to be a very prosperous one. It is said that the **Eastman Kodak** plants are now running at full capacity. The **Bausch & Lomb** optical works have its full complement of help, and similar conditions exist in Lincoln Park, where the **General Railway Signal Company** and **Pfaulder** plants are located. The **Northeast Electric Company** is now employing a night shift so heavy have become orders for its products. The **Van Bergh** silver-plating works in Main street west are working full time and cannot keep up with their bookings.

The annual banquet of the Rochester branch of the American Electro-Platers' Society was held at Powers Hotel on the evening of March 6th. G. B. E.

DETROIT, MICH.

March 1, 1923.

But little if any change has taken place here during the last month in the brass, copper and aluminum industry. Conditions have been excellent all through the winter and the only handicap reported has been the lack of fuel in the early months and congested terminals here which have hampered the delivery of products and the reception of raw materials. These conditions, however, are rapidly clearing and the spring seems to be opening up with prospects of continued good business.

One of the most modern enameling plants in the world is a feature of the **Olds Motor Works** at Lansing, Mich. In a building 365 feet long, 95 feet wide and three stories high and

recently constructed, is housed one of the most ingenious automobile devices in the world. The first story is entirely given over to the storage and finishing of stock and to the cleaning of parts to be enameled. On the second floor each piece is inspected and dusted before the enameling process is started. The plant is attracting considerable interest among those engaged in the enameling business owing to the novel methods employed and the great saving of labor that attend them.—F. J. H.

PITTSBURGH, PA.

MARCH 1, 1923.

Metal consumers throughout the State of Pennsylvania, continue extremely active, and all metal sellers are highly optimistic of the future. Every week sees further expansions indicated, and it is hard to see why the current year will not be a banner one for practically all non-ferrous metals. Most of the activity is confined to domestic business, but it is felt that a corresponding foreign demand for metals, although likely to be delayed longer than was expected, is nevertheless sure to develop. This foreign demand may finally arrive just in time to take up any slack in domestic business. The copper market at least seems to be permanently on the up grade; lead is as strong as ever; tin is advancing again; and zinc has again taken a firm turn for the better.

The Aluminum Company of America, which has its headquarters in Pittsburgh has been awarded a contract for 530 miles of steel reinforced aluminum cables, totaling 1,800,000 pounds, for the Hetch Hetchy Moccasin Creek Power Plant project.

The National Lead Company declared the usual quarterly dividend of $2 on its common stock payable March 31, 1923.

H. W. R.

BOSTON, MASS.

MARCH 1, 1923.

Demand for metal products is showing a slight increase over last month. Higher metal prices and the expectation of still further advances is causing firmer buying in many lines. Shops are operating from 75 to 100 per cent of capacity and the labor situation is satisfactory.

Brass foundrymen report a small gain in orders over January and indications point to a larger volume next month. Managers, however, are not allowing themselves to become over optimistic because of the present bright outlook, and a general feeling of caution seems to prevail. One foundry manager expressed what appears to be the general attitude of the trade to the writer, when he said that although his plant was running close to capacity with a continued increase in orders expected, he was advancing mighty cautiously.

The Thomann Bronze & Brass Foundry is operating practically at capacity. Their business so far this year has shown a decided improvement compared with the same period in 1922. Gradual improvement is also reported by the **Star Refining Company** whose plant is running at about 75 per cent of capacity.

Severe weather has handicapped building operations considerably during the month, but the demand for plumbing and other supplies has held up well. The **Chadwick-Boston Lead Company** reports a slight improvement in business over January, although no great activity is expected until spring building gets under way.

Hersey Manufacturing Company, manufacturers of water meters, is having a 5-story building erected that will cost about $50,000. The first two floors are to be used for offices, the third and fourth for the manufacture of parts and the fifth will be a brass foundry extension.

The Metalcraft Company, of Taunton, has been incorporated with $10,000 capital to manufacture metal products and jewelry. Incorporators are Everett Bellany, Raoul D. La France, Lester Cohen and Joseph Cohen, all of Boston.

Hub Metal Spinning, Inc., of Boston, has been incorporated with $25,000 capital by Harry Clayman, Joseph Abrams and Samuel Pristaw.

Roebuck Supply Company, of Boston, has been incorporated, to handle metal products, with $100,000 capital by John A. Covenery, Anna Curland and Malcolm McLaughlan.

—C. W. R.

TRENTON, N. J.

MARCH 1, 1923.

The metal industry continues to hold its own in this section and the manufacturers are elated over the prospects for the coming spring and summer. More than $2,500,000 worth of building is scheduled for Trenton alone in the early spring and this will greatly aid the metal industry. It is expected that the big pottery strike, which has been in progress for several months, will have been settled by next month. The Trenton plants turn out considerable brass and copper trimmings for the many pottery industries here.

Copper Products Corporation, of 1160 Fairmont avenue, Elizabeth, N. J., has been incorporated at Trenton, N. J., with $200,000 capital to manufacture and deal in copper radiators. The incorporators are Charles J. Skinner, 9 Rutgers avenue, Jersey City; Alfred F. McCabe, 19 Tompkins place, Brooklyn, and John R. Turner, of Basking Ridge, N. J. Austin H. Hart is named as the agent in charge.

T. G. Glaser Company, Inc., of 93 Lafayette street, Newark, N. J., has been incorporated at Trenton with $50,000 to manufacture, buy, sell, design, invent and make up and deal in and with gold and silver, enameled and jeweled emblems, medals, etc. The incorporators are Theodore G. Glaser and Emma L. Hutt, both of 227 West End avenue, Newark and Harry V. Leach and Hannah C. Leach, of 210 Walnut street, Newark.

Newark Metal Manufacturing Company, of 776 Broad street, Newark, N. J., has been incorporated at Trenton with $10,000 capital to manufacture milling supplies, machinery and electrical appliances and to carry on the business of mechanical engineers, toolmakers, founders, metal manufacturers, cutlers and fitters. The incorporators are Max Fishman, 1019 Boston road, Bronx, N. Y.; Harry Fishman, 53 West 112th street, New York; Nathan H. Aterman, 1528 Minford place, Bronx, N. Y., and Louis K. Press, 776 Broad street, Newark, N. J.

Suit has been instituted in the Court of Chancery by **Adrain Vermeule,** of New Brunswick and the **Thorne Roller Skate Corporation** against the **American Non-Ferrous Metals Corporation,** of 113 Union street, Elizabeth, to determine upon an equitable distribution of the stock of the latter corporation. The complainants charge that they are threatened with being ousted from the company. The skate company was organized in 1919 to manufacture skates, using patents held by **Edward Thorne.** The Metals Company spent upwards of $40,000 on an auto wheel invented by **Rudolph R. Grant.** Grant obtained a patent in his own name and assigned it to the company, but did not record it. Grant it is claimed, seeks to dominate the Metals Corporation in his own interest. Vermeule declares he had financed the corporation from the beginning and has worked in its interests without compensation. An injunction order signed by Vice-Chancellor Church temporarily restrains Grant and three others from voting at any meeting of the company stock which stands in their names. Transfer of Grant's patent is similarly restrained.

Unique Metal Works, of Newark, N. J., has been incorporated at Trenton, with $10,000 capital to manufacture metal articles. Louis Ogust, of Edgewater, filed the papers.

Bradshaw Brothers, Inc., electrical appliances, of Newark, has been incorporated at Trenton with $100,000 capital. The papers were filed by Morris Gordon.

American Electrical Instrument Company, of 147 Palisade avenue, Union Hill, N. J., has been incorporated with authorized capital stock of 1,000 shares to produce electrical instruments. Charles E. Deibicht, Herman Bueche and James Garfield are the incorporators.

C. A. L.

PROVIDENCE, R. I.

MARCH 1, 1923.

There has been a general improvement in every line of the metal trades and at the present time there is hardly a worthy man desirous of a job that is out of work and the present outlook is very promis-

ing. In this connection a summary of the annual report of the Chief Factory Inspector J. Ellery Hudson, presented to the General Assembly a few days ago is especially interesting, as it shows that during 1922 there was an increase of 3,722 in the number of men employed in the 8,045 places of business inspected over the total employed in 1921.

The **Hansen & Van Winkle Company,** of Newark, N. J., manufacturers of platers' equipment and supplies, have recently taken over the business of the R. A. McIntire Co., 137 Chestunt street, Providence, and will continue it as a branch to be known as the Providence-Hansen-Van Winkle Company. Mr. McIntire will act in the capacity of district manager throughout the New England territory. A complete line of the firm's goods will be kept on hand and all orders filled for this territory from the branch office.

The **H. J. Astle Company,** of this city, continues to be busily engaged in getting out the new patent Boland systems for various jewelry and other concerns throughout the country. During the last few weeks they have shipped and installed a Boland polishing bench and dry dust collecting system in the factory of the C. H. Eden Company at Attleboro, Mass. and a complete coloring system for the DeVilbiss Manufacturing Company at Toledo, O. The Scovill Manufacturing Company, at Waterbury, Conn., has recently placed an order with the Astle Company for seven Boland patented metal dryers which, when installed, will make a total of fourteen driers in that factory.

State Labor Commissioner George H. Webb of Providence has been re-elected by the Rhode Island Senate for a term of two years, defeating Edward H. Morris of Cumberland, whose candidacy was supported by the labor organizations of the State. Mr. Morris was also the appointee of Governor Flynn, but was one of those rejected by the Senate in favor of the present office holders.

W. H. M.

MONTREAL, CANADA

MARCH 1, 1923.

Everything indicates that the return to normal conditions has already begun. Although there is no boom in view it must be taken into consideration that booms do not denote normal times. Times that are considered normal are times when there is sufficient work for every one and a sufficient number of workmen to do the work.

Inquiries amongst the jobbing foundrymen show that business is in a more healthy state than a year ago and orders for castings are more numerous and more profitable. The plating industry at this time is in a healthy state and the prospects are promising for a large business this spring.—P. W. B.

Business Items—Verified.

H. M. **Lane Company,** Owen Building, Detroit, Mich., has recently moved its offices to 333 State street.

A. P. **Munning & Company,** formerly of 50 Church street, New York, have moved to 52 Vesey street, New York.

Peru Foundry Company, Peru, Ind., reports that the rumor concerning anticipated building of an extension is unfounded.

Peters & Russell, Inc., Wollaston, Mass., have moved their factory and general offices to take care of their increased business.

The Jonathan Bartley Crucible Company, Oxford street, Trenton, N. J., has filed notice of increase in capital from $125,000 to $500,000.

The U. S. Industrial Chemical Company, Inc., has moved its offices from 27 William street, New York, to 110 E. 42nd street, New York.

Solomon-Abbott Company announce a change of name to **Abbott, Merkt & Company, Inc.,** Industrial Engineers, 175 Fifth avenue, New York.

U. T. Hungerford Brass & Copper Company announces the opening of an office in the Leader Building, Superior avenue and East 6th street, Cleveland Ohio. W. A. Amelung is in charge.

The Manhattan Brass Company, 332 East Twenty-eighth street, New York, will install additional equipment at its power plant, in connection with extensions and improvements to cost $25,000.

It has been stated in the daily press that both the Krupp and Stinnes interests in Germany have made far-reaching contracts for enormous quantities of tin and copper with the largest concerns in the Netherlands.

The United States Can Company, Cincinnati, Ohio, has awarded contract for a reinforced concrete addition to its plant at Norwood, three stories, 80 x 120 ft. With equipment, it will cost approximately $100,000.

The Dean Metal Company, 108 Pine street, St. Louis, Mo., recently organized, will operate a plant for the manufacture of metal cabinets and toilet specialties. This firm operates the following departments: brazing, plating, japanning, tinning, polishing and lacquering.

On Friday, March 9, 1923, the New York (Hudson River) water front plant, the North (Brass) Plant of the **National Conduit & Cable Company, Inc.,** Hastings-on-the-Hudson, N. Y., which consists of 10 acres, 15 buildings and equipment, was sold at auction.

The Magnus Chemical Company has moved to larger quarters at 728 Atlantic avenue, Brooklyn, N. Y. The organization has been augmented by the addition of a number of field and inside men, and a number of new cleaners have been added to the company's line.

O. H. **Ertzinger,** Bay Minette, Ala., is organizing a company to establish and operate a plant to manufacture mechanical and other toys. A metal-working department will be installed. This concern operates the following departments: stamping and lacquering.

The International Sales Company, 832-33 Hearst Building, San Francisco, California, has been organized to promote the export sales of American products. The company will open its central foreign sales office in Shanghai, China, from where its foreign sales policies will be directed.

Arthur D. Little, Inc., 30 Charles River Road, Cambridge 39, Mass., announces the coming to its organization as Gas Engineer of **Alfred I. Phillips,** formerly Associate Gas Engineer of National Bureau of Standards, and lately Service Engineer of American Gas Association.

John C. Wiarda & Company, Brooklyn, N. Y., manufacturers of chemicals have increased their capital stock from $40,000 to $115,000. Howard B. Bishop, president of the company, reports that this has become necessary in order to take care of increasing business and to provide for future extension.

Among the art treasures found in the tomb of **Tut-Ankh-Amen** were the Royal Uraeus or Cobra on the forehead of his statue made of inlaid bronze. A bronze snake inlaid with gold was found in a box in a passage to the tomb, and a crown of Egypt of wrought bronze and crusted gold.

The Empire Tinware Company, 33 South Fifth street, Brooklyn, N. Y., is taking bids on a general contract for a four-story addition, 100 x 125 ft. to cost about $65,000. Improvements will also be made in the present works. This concern operates the following departments: japanning, stamping and soldering.

Manistique Brass & Bronze Company, Manistique, Mich., has completed an addition to its building on East Main street and intend to build two more additions in the early spring. This concern operates the following departments: brass, bronze and aluminum foundry, machine and pattern shop.

The Boston offices of **Wing & Evans, Inc.,** sales agent for the Solvay Process Company have been moved to 77 Summer street. The new and improved offices are very conveniently located for the trade. All sales of Solvay soda ash, caustic soda and modified sodas for the New England territory are handled through this office.

The Martin Metals Corporation, Newark, N. J., has leased a portion of the four-story building at 115-117 Monroe street, from the Foster Engineering Company for a new plant to manufacture aluminum and other castings. This firm operates the following departments: aluminum foundry, casting shop, spinning, stamping and pattern.

Jacob A. Rappaport, West and Milton streets, Brooklyn, N. Y., manufacturer of metal doors and sash, has removed his plant to the building at 77-103 Dobbin street, where increased

facilities will be provided. This concern operates the following departments: brass machine shop, brazing, soldering, polishing and lacquering.

G. J. Nikolas & Company, 1227 West Van Buren street, Chicago, Ill., manufacturers of lacquers and kindred products, will soon award a general contract for the erection of their proposed new 3-story plant, 50 x 70 ft., adjoining the present works, to cost approximately $50,000. They are building for additional storage and manufacturing space.

The La Porte Brass & Aluminum Foundry Company, La Porte, Ind., recently started operations. The foundry will confine itself to the manufacture of small brass and aluminum castings. They also do match plate work for the pattern shops in this section. This concern operates the following departments: brass, bronze and aluminum foundry.

Bridgeport Testing Laboratory, Bridgeport, Conn., has always accepted electro-plating problems and tested solutions, but recently the demand for their services in this field has become so extended that it has been decided to establish a separate department devoted entirely to this line of work. Their metallurgical work will be continued as usual.

The De Long-Kendrick Company, Newark, N. J., has been incorporated with a capital of 1,000 shares of stock, no par value, to manufacture metal alloys. The incorporators are Louis DeLong, Richard B. Downing and Kenneth A. Depew, 345 Halsey street, Newark. This concern operates the following departments: smelting and refining, rolling mill, stamping.

The Fly-Lock Knife Company, Bridgeport, Conn., recently organized, has leased a building formerly occupied by the Challenge Cutlery Company for a new plant to manufacture a patented press-button pocket knife. This concern operates the following departments: brass machine shop, grinding room, cutting-up shop, spinning, plating, stamping and polishing.

Kirke, Roche & Company, who opened a sheet metal plant at 338 Seventh street, San Diego, Calif., a few months ago have taken larger quarters at 546 Market street in that city. The firm specializes in restaurant equipment, furnaces, heating and ventilating, skylight and cornice work, operating tinning and soldering departments. They will need all kinds of tools and equipment.

The Patton-MacGuyer Company, metal goods and jewelry manufacturer, 31 Mathewson street, Providence, R. I., has awarded contract to the C. I. Bigney Construction Company, 357 Westminster street, for a new one-story and basement factory 50 x 120 ft. at Manucentre, Providence. New equipment will be installed. This firm operates the following departments: tool room, cutting-up shop, stamping.

The Chalfant Can Company, 1966 South Meridian street, Indianapolis, Ind., is considering the erection of a one and two-story plant in the vicinity of Fort Wayne, Ind., estimated to cost $55,000. L. A. Corcoran is General Manager. They make new 5, 8 and 10 gallon milk shipping cans and re-tin old milk and ice-cream cans. This firm operates the following departments: tool room, stamping, tinning, soldering.

The Wisconsin Metal Manufacturing Company, operating factories in Prairie Farm, Wis., and Chicago, has decided to consolidate its works at Chippewa Falls, Wis., where an existing building has been purchased and is being altered and re-equipped until a new plant can be erected. The concern manufacturers steel, copper and tin sheet metal goods, blower systems, air moistening devices and other sheet metal specialties.

The International Nickel Company, New York, issued a comparative consolidated general balance sheet nine months ending December 31, 1922. Their profit and loss statement showed a deficit of $383,130.35. This, however, was due to the heavy cost of shutting down. The operating figures showed a balance of $71,-363.31 after preferred dividends had been paid. This was a marked improvement over the last report.

The American Engineering Company, of Philadelphia, manufacturer of Taylor Stokers and A-E-Co. Marine Auxiliaries, has taken over the **Standard Crane and Hoist Company** and the patent and manufacturing rights to the mono-rail electric hoist with the low headroom formerly known as the Standard. Literature is now ready for distribution upon request to the American Engineering Company.

The Standard Wire Company, 706 West Grant street, Newcastle, Pa., has acquired the plant and equipment of the Buckeye Register Company, Warren, Ohio, and will remove the work to Newcastle. A new building will be erected. It is proposed to continue certain products of Buckeye manufacture. Jonas Kaufman is president. This concern operates the following departments: plating, japanning, stamping, polishing and lacquering.

The American Smelters Securities Company has transferred all of its assets to the **American Smelting & Refining Company,** and the business and plant formerly conducted by the Selby Smelting & Lead Company, and later by the American Smelters Securities Company, has since January 1, 1923, been conducted under the same management in the name of the American Smelting & Refining Company, who have assumed all assets and liabilities. The company is located at 444 California Street, San Francisco, Calif.

The Shawinigan Foundries, Shawinigan, Que., Canada, recently acquired by W. G. Dauncey, propose to begin work in the spring on the erection of a steel foundry. Since they started operations last October, they have built a new foundry with new core rooms and ovens. Production at present consists of gray iron castings, special acid resisting and other alloys, as well as brass, bronze and aluminum castings, etc. This firm operates the following departments: brass, bronze and aluminum foundry, brass machine shop, grinding room, casting shop.

The Hydraulic Press Manufacturing Company, Mt. Gilead, Ohio, has increased its capitalization from $200,000 to $1,200,000 and the company will shortly issue $440,000 worth of 7 per cent preferred stock. It manufactures hydraulic presses, pumps, valves, accumulators and intensifiers as well as fruit juice presses. The company now operates machine, pattern and erecting shops, and gray iron and brass foundries. It is contemplating extensions to all these departments. This concern operates the following departments: brass foundry, brass machine shop, tool room, casting shop.

Due to the rapid increase in their business in the equipping of jewelry shops and factories, **Leiman Brothers** have found it necessary to remove their New York office and show room to larger quarters at 60-62 Lispenard street where they will have a much larger show room and facilities for carrying a very large stock of goods for immediate shipment. They will be prepared at all times to receive inquiries for re-built, as well as new machinery, and in this way they are prepared to equip shops at very reasonable rates. When a concern is starting in business, rebuilt machinery is often to be preferred on account of the great saving.

The American Metal Products Company, Milwaukee, Wis., manufacturers of Ampco, a copper aluminum steel alloy of high tensile strength and acid resisting, report an increase of 400% in their business over the previous year. They have just installed a Detroit Electric Rocking Type furnace to take care of their growing business in ingots and castings. By spring, they will have installed a new rolling mill electrically driven, five sets of housings, three rolls high—a ten inch mill—to roll their own sheet, strips, rod, etc. They also, contemplate the installation of a wire drawing equipment.

A plan for the reorganization of the **Cleveland Brass and Copper Mills, Inc.,** has been prepared and a syndicate committee appointed to act for the stockholders. To provide funds for the purchase and operation of the plant the plan calls for a subscription from the old stockholders.

It is the intention to secure the syndicate members to the amount of their assessment by the issuance of first mortgage bonds with suitable sinking fund and retirement provision. On December 11th of the last year Charles L. Anderson, President of C. L. Anderson and Company, Industrial Managers and Engineers of Cleveland, Ohio was appointed Receiver for the company.

The Berks Foundry & Manufacturing Company, Hamburg, Berks Post Office, Pa., which operates jobbing foundries at Hamburg, Pa., and Watsontown, Pa., has completed improvements to both of its plants. At Hamburg a fire-proof building, 60 x 140 ft. has been finished and is being equipped with machinery. This will not only enable the company to finish its own castings, but the addition of a wooden and metal pattern department will enable it to make all its own patterns. During the past year an addition was built to the foundry and a sand blast machine installed. This concern operates the following departments: brass, bronze and aluminum foundry, brass machine shop, grinding room, casting shop, plating.

Sealed proposals, in triplicate, will be received at the Office of the **General Purchasing Officer of the Panama Canal,** Washington, D. C., not later than 10:30 o'clock a. m., on the 14th day of March, 1923, at which time they will be opened in public, for furnishing by steamer, free of all charges, on dock at either Cristobal (Atlantic port) or Balboa (Pacific

port), Canal Zone, Isthmus of Panama, the articles hereinafter specified. For information write to the Office of the General Purchasing Officer of the Panama Canal, Washington, D. C. Invitation for proposals to furnish **brass cocks, special bronze, yellow metal, sheet lead, melting furnace crucibles, foundry brushes.**

INCORPORATIONS

The **Aluminum Foundry Company,** Boston, Mass., has been incorporated with a capital of $10,000, to manufacture aluminum, bronze and other metal castings. Harry D. Finberg is president. They are in the market for hand squeezers and gas brass furnace for No. 60 crucible. This concern operates the following departments: brass and aluminum foundry, grinding room, casting shop and polishing.

The National Can Corporation, Detroit, Mich., recently organized with a paid-in capital of $1,500,000, has acquired the business of the company of the same name at 2566 East Grand Blvd. Plans are under way for enlargements, including the automobile radiator department. This concern operates the following departments: tool room, grinding room, stamping, tinning, soldering and polishing.

The Murphy Furnace Company, Seventeenth street and First Avenue, Beaver Falls, Pa., recently incorporated with capital stock of $50,000, will engage in the manufacture and installation of warm air furnaces. A two-story building will be erected 30 x 60 ft. for the beginning. The company will be in need of tin shop equipment also casing ring, galvanized sheets, pipes, boots, etc.

The Globe Sheet Metal & Furnace Works, 567 Third street, Milwaukee, Wis., has incorporated as the Globe Sheet Metal Company, with a capital stock of $12,000. A general line of tin galvanized and copper products is manufactured. They are at times in the market for cold rolled copper for boilers, boiler handles, etc.

William J. Sweet Foundry Company, Inc., 2527 East York Street, Philadelphia, Pa., has been incorporated under New Jersey laws to produce Inco Monel metal and nickel castings under the direction of W. J. Sweet, who was associated with the International Nickel Company for over twelve years and for the last two years has conducted an experimental foundry at Bayonne, N. J., in order to develop ideas in casting Monel metal. These castings are now being produced in considerable quantities. In an effort to overcome difficulties encountered in casting this metal an electric furnace of the Repel-Arc type has been installed in addition to crucible furnaces.

The Reading Machine & Tool Company, 437 Washington Street, Reading, Pa., was recently incorporated with capital stock of $25,000 and will take control of an existing business which will be continued as manufacturers' agent and jobber of metal and woodworking machinery and tools, electric motors, industrial furnaces, etc. No change will be made either in personnel or operation.

BABBITT METAL AND SOLDER IN 1921

The Department of Commerce announced that according to reports made to the Bureau of the Census the value of products of establishments engaged primarily in the manufacture of Babbitt metal and solder amounted to $26,255,000 in 1921 as compared with $59,017,000 in 1919, and $19,180,000 in 1914, a decrease of 55.5 per cent from 1919 to 1921, but an increase of 36.9 per cent for the seven-year period 1914 to 1921. In addition, establishments manufacturing other products of chief value reported Babbitt metal and solder to the value of $8,482,000 in 1919, and $3,538,000 in 1914; corresponding figures for 1921 are not available at this time.

Of the 98 establishments reporting products valued at $5,000 or more in 1921, 22 were located in New York; 13 in Pennsylvania; 11 in Illinois; 8 in New Jersey; 6 in Ohio; 5 each in Massachusetts, Michigan, and Missouri; 4 in California; 3 in Virginia; 2 each in Colorado, Connecticut, Maryland, Oregon, and Washington; and 1 each in Georgia, Indiana, Minnesota, Nebraska, Tennessee, and Wisconsin. Illinois, the leading state in the industry in 1921, reported 36.7 per cent of the total value of products in that year.

In October, the month of maximum employment, 1,450 wage earners were reported, and in August, the month of minimum employment, 1,228, the minimum representing 84.7 per cent of the maximum. The average number employed during 1921 was 1,372 as compared with 2,372 in 1919. The reports show that 490, or 35.7 per cent of the total average number of wage earners, were employed in establishments where the prevailing hours of labor per week were 48 and less; 332, or 24.2 per cent, where the hours were between 48 and 54; and 549, or 40 per cent, in establishments where the prevailing hours were 54 and over.

The statistics for 1921, 1919, and 1914 are summarized in the following statement; the figures for 1921 are preliminary and subject to such change and correction as may be found necessary from a further examination of the original reports:

	1921[1]	1919[1]	1914[1]
Number of establishments	98	111	95
Persons engaged	2,089	3,372	1,686
Proprietors and firm members	69	63	69
Salaried employees	648	937	582
Wage earners (average number)	1,372	2,372	1,035
Salaries and wages	$3,476,000	$5,053,000	$1,614,000
Salaries	1,596,000	2,171,000	913,000
Wages	1,880,000	2,882,000	701,000
Paid for contract work	17,000	3,000	2,000
Cost of materials	22,355,000	48,844,000	15,652,000
Value of products	26,255,000	59,017,000	19,180,000
Value added by manufacture[2]	3,900,000	10,173,000	3,528,000

[1]Statistics for establishments with products valued at less than $5,000 are not included in the figures for 1921. There were 10 establishments of this class, which reported 6 wage earners and products valued at $24,000. For 1919, however, data for 7 such establishments, reporting 3 wage earners and products valued at $19,000, and for 1914, 14 such establishments, with 5 wage earners and products to the value of $38,000, are included in all items with the exception of "number of establishments."

[2]Value of products less cost of materials.

AUTOMOBILES USED 54,140 TONS COPPER

In the manufacture during 1922 of 2,527,000 cars and trucks in this country, 108,280,000 pounds of copper was used according to statistics given out by the Copper and Brass Research Association. In 1923, the association estimates, on figures of automotive production which that industry predicts will reach the record figure of 2,000,000 cars and trucks, that 120,000,000 pounds of copper will be consumed. This figure is based on past consumption averages per each stock car and does not include the additional amount which will probably go into the construction of contemplated accessories. The association estimates that the inclusion of these accessories will use up an additional 5,000,000 to 75,000,000 pounds, bringing the total estimate for 1925 up to 125,000,000 to 135,000,000 pounds of copper.

In its statement, the Copper and Brass Research Association presented the following facts and figures relative to the increasing demands for copper from the automotive industry:

"The average copper content of each unit of output, including the copper in brass and bronze parts and fittings, was ascertained to be thirty pounds on a new car basis. This average is increased to thirty-three pounds by special body work and accessories. A study of the trend of automotive construction indicates that the use of copper and its alloys, after decreased use of these metals during war years, is now steadily increasing. Present manufacturing methods make it possible to increase the copper content of the car without appreciable effect upon production costs.

"Concrete examples of the wider use of copper and copper metals are: Replacement of cast-iron bushings with bronze on small pins and spindles, and the use of bronze bushings on parts formerly unbushed; installation of nickeled-brass hardware and fastenings, and nickel-silver or brass trim and stripping; use of sheet copper or brass radiator tanks, nickeled or enameled brass hubcaps, and a more general use of brass screws, nuts or bolts in order to prevent seizing or rusting in threads."

OLD BRONZE AND BRASS THIMBLES

Bronze or brass were used for thimbles as long ago as it is possible to trace this humble but extremely useful article. Bronze thimbles, open at the top like those used by tailors, have been found among the ruins of Herculaneum, which was destroyed with Pompeii during the eruption of Vesuvius in A. D. 79. Indeed, the thimble in its now recognized form has been used for some 2,000 years.

Bronze or brass thimbles, differing little in appearance from the

modern type, have been found in the excavations of Roman dwellings in London, as well as in the Thames off Dowgate. They are unquestionably of very early date. All are of bronze or brass, in excellent condition, and are of two distinct types. One is composed of a strip of metal about 8/12ths of an inch wide, rolled round and soldered, leaving the end open in the fashion of the specimens discovered at Herculaneum. Either extremity is encircled by a plain band, the space intervening being thickly pounced with small indentations, similar to the milling of the thimble of the present time.—BULLETIN OF THE COPPER AND BRASS RESEARCH ASSOCIATION.

MANUFACTURE OF BELLS IN 1921

The Department of Commerce announces that according to reports made to the Bureau of the Census the value of products in establishments engaged primarily in the manufacture of bells amounted to $645,000 in 1921, as compared with $951,000 in 1919, and $970,000 in 1914, a decrease of 32.2 per cent from 1919 to 1921, and 33.5 per cent for the seven-year period, 1914 to 1921.

Of the 9 establishments reporting in 1921, 3 were located in Connecticut; 2 each in Missouri and New York; and 1 each in Illinois and Ohio.

There was not much fluctuation in the monthly employment of wage earners during the year. In January, the month of maximum employment, 226 were reported, and in August, the month of minimum employment, 179, the minimum representing 79.2 per cent of the maximum. The average number employed during 1921 was 203, as compared with 237 in 1919. The reports show that 32, or 15.8 per cent of the total average number of wage earners, were employed in establishments where the prevailing hours were less than 54 per week; and 171, or 84.2 per cent, where the hours were 54 per week.

CHEMICAL ANALYSIS OF BABBIT METAL

The American Engineering Standards Committee, 29 W. 39th street, New York, has approved as "Tentative American Standard" the methods for the chemical analysis of alloys of lead, tin, antimony and copper—otherwise known as babbitt metal—submitted by the American Society for Testing Materials.

Two methods of analysis are included in the document approved by the A. E. S. C. The first is a quick and fairly accurate method intended for practical or shop use; the second is a slower, more elaborate and more expensive, and more exact method intended for reference purposes or for the settlement of disputed questions.

The approval of the A. E. S. C. was voted on the recommendation of a special committee representative of all the interests concerned with the subjects, of which George C. Stone was chairman.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$475	$525
American Hardware Corporation	100	48	49
Bristol Brass	25	13	18
International Nickel, com	25	15¼	15½
International Nickel, pfd	100	75	77¾
International Silver, com	100	50	...
International Silver, pfd	100	104	...
New Jersey Zinc	100	172	175
Rome Brass & Copper	100	115	...
Scovill Manufacturing Co., new	...	160	170
Yale & Towne Manufacturing Co., new	...	61	63

Corrected by J. K. Rice, Jr., Co., 36 Wall Street, New York.

TRADE PUBLICATIONS

Liftabout.—A folder issued by Shepard Electric Crane & Hoist Company, Montour Falls, N. Y., on their electric hoist.

"Zamium." A folder issued by the Zamium Corporation, Boonton, N. J., describing "Zamium," primarily a substitute for platinum.

A Story from Sherry's.—A folder issued by Bridgeport Brass Company, Bridgeport, Conn., on brass pipe for hot and cold water supply.

Rensselaer Polytechnic Institute Bulletin.—A catalog issued by Rensselaer Polytechnic Institute, Troy, N. Y., on its chemical engineering course.

New York Metal Exchange. A booklet issued by the New York Metal Exchange, 111 Broadway, New York, giving general trade rules for dealing in metals.

Paxs-on-Ward.—A folder issued by the J. W. Paxson Company, Philadelphia, Pa., illustrating and describing their sand blast machinery designed for any or all pressures.

Microscope Stands.—A folder issued by Adam Hilger, Ltd., 75a Camden Road, London, N. W. 1, England, on interference accessory for testing microscope stands and fine adjustments.

Worth Looking Into. A folder issued by J. W. Paxson Company, Philadelphia, Pa., illustrating and describing their Paxson-Collian Cupola, built for the foundryman who wants hot iron.

Mono-Line, Bulletin No. 70, issued by the Quigley Furnace Specialties Company, Inc., 26 Cortlandt Street, New York, describing the application of "Mono-Line" in iron and brass foundry practice.

Automatic Rotary Furnace and Quenching Tank. Circular No. 245, issued by W. S. Rockwell Company, 50 Church Street, New York, covering the Rockwell combination automatic heating-cooling unit.

The National Research Council.—Its Services for Mining and Metallurgy, by Alfred D. Flinn, vice-chairman, Division of Engineering National Research Council, Washington, D. C. Reprint and circular series.

Burners.—Pride List No. 6 issued by Combustion Utilities Corporation, successor to the Improved Appliance company, 413-19 Kent avenue, Brooklyn, N. Y., consisting of a complete price list on standard appliances and accessories, and burners and parts.

"Heroic Deeds of the Dingville F. D." A booklet issued by the American La-France Fire Engine Company, Inc., Elmira, N. Y. It contains a collection of cartoons by a well-known cartoonist, who was a volunteer fireman a number of years ago.

Borolon-Polishing Grain. A booklet issued by the Abrasive Company, Philadelphia, Pa. The booklet is devoted largely to descriptions of Borolon abrasive grain for polishing purposes. Sans-slip floor tread material, which is used for non-slip purposes, is also described.

Electro-Plating & Polishing Supplies, Catalogue No. 23, issued by the Hanson & Van Winkle Company, N. J. This is a very handsome catalogue, which illustrates and describes the latest improvements in electro-plating and polishing equipment and supplies of that company.

Safe Tapping and Stopping.—A folder issued by the Medart Company, St. Louis, Mo., describing a new safety invention which is soon to be put on the market. This device is said to remove the hazards from cupola tending and prevents the serious accidents which sometimes occur.

Boiler Furnace Economies.—Bulletin No. 53, issued by the Quigley Furnace Specialties Company, 26 Cortlandt street, New York, illustrating and describing a method of reconstructing and patching boiler furnace walls. This method makes use of old furnace linings which are crushed and then mixed with Hytempite to bond the crushed material.

Smith, Richardson Company Machines.—A booklet issued by the Smith, Richardson Company, 40 Dunham street, Attleboro, Mass., illustrating and describing their polishing, tubbing and drying out machines, which are now in general use among nearly all the manufacturers of jewelry, silver novelties, optical goods, surgical instruments, safety razors, pencil tubes, gold teeth, silver, gold, brass, etc.

Hardinge Conical Mills.—Catalog Number 13, issued by the Hardinge Company, 120 Broadway, New York. This bulletin treats the matter of pulverizing and grinding both wet and dry. It takes up the principles of grinding and how these principles apply to any class of material whether this grinding is to be accomplished wet or dry, or whether the product desired is to be as granular as possible or extremely fine and uniform in texture.

To Make a Good Car Better. A booklet issued by Copper & Brass Research Association, 25 Broadway, New York, referring to the metal, copper, and its alloys, brass and bronze as indispensable in the construction of the modern automobile. This booklet has been prepared to inform the car owner where copper, brass and bronze logically belong in automotive construction and why these enduring metals increase the serviceability of the automobile.

Review of the Wrought Metal Market

Written for The Metal Industry by J. J. WHITEHEAD, President of the Whitehead Metal Products Company of New York, Inc.

All predictions made during the past few months of higher prices for brass and copper materials are now justified by the remarkable series of advances in price made effective recently. An enormous volume of business has been placed and practically all the mills have their entire capacity filled for from three to five months. In addition to the orders actually placed, a number of consumers find themselves in need of material which they are unable to purchase because of the crowded conditions of the mills and there are many orders which they have not been able to place. Most of the mills are not interested in orders coming from concerns who have not been regular customers because of the realization that it requires every possible effort to meet the needs of their established trade.

This situation is all the more remarkable when consideration is given to the enormous increase in the capacity of all of the mills as compared with the pre-war capacity. Some time ago, we commented on the fact that the production capacity of all the mills had been doubled or tripled during the war. It can be readily seen that as this capacity is now taxed to the utmost, the volume of business must be greatly in excess of any that the industry has ever seen with the possible exception of the war years. In some departments the bookings are actually in excess of what they were during the war. All of this activity has been developed out of conditions existing in this country, and with an absolute disregard of the situation abroad. Practically all the material ordered is going into consumption and to fill actual needs, so that it is not felt there is any danger in the situation due to possible accumulation of stocks which might have to be unloaded later. The automobile and building industries as well as the electrical trades are consuming large quantities of brass and copper and the wireless business is again contributing its share to the volume of orders. Some apprehension is felt that the prices may advance to a level which would have a tendency to curtail the demand. It is feared that if the prices of ingot copper and zinc are moved up to a level much above the present range of prices there is apt to be a tendency on the part of consumers to substitute cheaper metals. This is not a new situation. It is something that has happened in the past, and can very readily occur again. It may be that in a series of wide fluctuations in price there is an accumulation of speculative profits, but it is certain that a lot of such profits made on a rise in the market are lost on the inevitable decline from high price levels. If the market can be stabilized at a fair price with reasonable manufacturing profits for all, the best interests of the trade would be served.

There is just as much increase proportionately in business in the other non-ferrous metals, such as nickel, nickel alloys and monel metal as in the brass and copper trade. The manufacturers of these products are all as far behind in their orders as the brass and copper mills and a large amount of business is being offered. There are, however, no tendencies in the direction of a runaway market, and few increases have been made in prices.

It is to be hoped that the copper and zinc market may be held in check and established on a fair price basis so that the industry may proceed to a proper development in furthering the extension of a steady consumption of brass and copper materials without having to combat the disquieting situations that arise out of a constantly fluctuating price schedule which is as disastrous on a falling market as it is interesting and profitable on a rising one.

Metal Market Review

Written for The Metal Industry by METAL MAN

COPPER

A heavy reduction in the refined surplus stocks, an unusually heavy domestic consumption, large exports and inability greatly to increase the rate of new output owing to the scarcity of miners have exerted a stimulating effect upon prices and given a strong undertone to the market. Domestic consumers and foreign buyers were actively in the market for prompt and future deliveries. Domestic buying was specially urgent, insistent and important.

Sales during February were surprisingly large. As prices continued to advance demand grew in intensity and offerings were eagerly snapped up. During the last four weeks prices advanced more rapidly than at any time in over two years. The February opening for electrolytic copper was 15 cents, but by the middle of the month the price had advanced to 15½, and as the month closed the market was firmly established on the basis of 16⅝c to 16¾c. The buoyance of the market recently and the heavy volume of domestic and foreign sales indicated definitely the large requirements in sight, particularly for domestic account. Brass and copper products have also been advanced in corresponding ratio to the raw metal.

There are further positive signs of increased market activity this date, with electrolytic selling at 16⅞@17 cents, delivered. Market has upward tendency and higher prices are expected. Current sales are heavy and new inquiries continue.

ZINC

With improved consumption and restricted offerings, price of zinc has advanced to 7.75 East St. Louis. This represents a rise of about ½ cent a pound in the last two weeks, and highest price in over two years. Domestic galvanizers and brass mills have bought actively recently, but at prevailing prices buyers were inclined to avoid bidding the market up on themselves.

Both production and shipments in January were on a record scale since the war years. Production of slab zinc during that month was 46,317 tons, and the shipments 47,995 tons, resulting in a reduction of stocks in smelters' hands during January of 1,678 tons. Stock on hand January 31, 1923, amounted to 16,574 tons, against stocks of 65,678 tons on January 31, 1922, being a decrease during the 12 months of 49,104 tons. The February statistics will not be ready for several days. Supplies for nearby shipment are scarce. Consumption continues heavy and a further urgent demand during the spring months is fully expected.

TIN

There has been a broad gain in the tin market and prices have risen rapidly in the last two weeks. London operations for larger movements and higher prices have succeeded immensely and the spectacular results are registered by a rise of 6⅜ cents per pound since February 1st and 14⅛c since September 5th.

Predictions of high prices for tin made months ago have been verified even beyond what was anticipated. Recent developments in the London market are highly sensational. The powerful speculative group are evidently in full control of the situation, and consumers, traders and dealers generally look upon the present stage of the market as extremely sensitive and nervous. On February 28 London cables reported an advance of £8.50 per ton for Straits tin, the quotation being £217. per ton. The local market was very firm on same date at 46¼c to 46¾c for February-March and April Straits.

Market displays increased strength for all positions on heavy London sales at a new high mark. New York prices for March-April delivery are from 46¾@47¼ cents. Domestic deliveries in February were 6,185 tons.

LEAD

The lead market holds strong at 8¼c@8½c New York and 8¼c East St. Louis basis. Consumption continues heavy and new demand is in substantial volume. Domestic supplies are still restricted and production does not increase fast enough to ease the quotational situation. Spot supplies are at a premium owing to

the small tonnage for sale. March and April deliveries are also strong. All lead consuming industries are extra busy, and producers offer cautiously. The stringency of the situation may lead to further market advances in the near future.

ALUMINUM

A firmer tone exists in the aluminum market and prices have stiffened all along the line. Foreign metal of 99% plus is quoting 25½c to 26c and 98-99% at 24½c to 25c. These figures represent importers views, but might be shaded ½c in the open market. The Aluminum Company of America, quote only on specifications and decline to quote for publication. There has been a large demand for aluminum wire recently for use in power plant equipment.

ANTIMONY

On increased demand the antimony market has developed a stronger tone. Offerings of Chinese material are limited, and the Orient is inclined to hold back shipments in expectation of getting higher prices. Chinese regular is quoted at 7⅜c duty paid. Offerings for shipment from China are made with reserve. Far East holders are evidently waiting for higher prices.

Firmer conditions have developed in this market as we go to press. Spot antimony has advanced to 7¾c, duty paid, with active demand for future shipments.

QUICKSILVER

There is no special activity to note in the demand for quicksilver. Prices have been steady recently at about $70 per flask, being a little lower range than was current a few weeks ago. A new source of supply is expected to be opened up in Japan where a rich quicksilver vein was recently discovered.

PLATINUM

There is no special activity to note in this market and current price is about $110 an ounce. Ordinary quantities are changing hands for the regular run of trade requirements.

SILVER

Increased demands are noted from China and India lately, and the market for bullion silver of foreign origin is considerably stronger than it was. Market prices on February 28th were 66¾ cents per ounce at New York and 31¾ pence at London. Total purchases to date under the Pittman Act amount to 160,625,601 ounces, leaving a remainder of 47,996,455 ounces to be purchased by the United States at the fixed price of $1 per ounce. Producers, smelters, miners and dealers are all considerably wrought up over the future course of silver when government purchases are completed. Unless the different governments of the world take steps to stabilize silver by increased use for coinage purposes prices are liable to recede when the United States stops buying.

OLD METALS

The tone of the market for scrap metals is distinctly firm and the general trend of prices has been on a rapidly mounting scale. There is a strong demand for all the leading scrap materials and the trade are eager buyers. The composition scraps, copper scraps, aluminum scraps, and brass turnings were in good demand. There are many indications of strength and activity in the scrap market. Operators and dealers believe the situation will develop greater firmness in sympathy with the outburst of strength going on in the primary metals. Prices dealers are willing to pay are as follows: Strictly crucible copper wire, 13½c@14½c; light copper, 11½c@12c; heavy brass, 7½c@8½c; new brass clippings, 9½c@10½c; sheet aluminum, 15c@16c; heavy lead, 6½c@6¾c; old zinc scrap, 4½c@5c, and battery lead, 4c@4½c.

WATERBURY AVERAGE

Lake Copper—Average for 1922, 13.844—January, 1923, 14.875—February, 15.75.

Brass Mill Zinc—Average for 1922, 6.283—January, 1923, 8—February, 8.

Daily Metal Prices for the Month of February, 1923

Record of Daily, Highest, Lowest and Average

Metal Prices for March 2, 1923

Date	1	2	5	6	7	8	9	12	13	14	15	16
Copper (f. o. b. Ref.) c/lb. Duty Free								Holiday				
Lake (Delivered)	15.125	15.125	15.125	15.125	15.20	15.20	15.20	.....	15.25	15.375	15.50	15.75
Electrolytic	15.00	14.90	14.90	14.90	14.90	14.90	14.90	.....	15.00	15.10	15.375	15.50
Casting	14.50	14.50	14.50	14.50	14.50	14.50	14.60	.....	14.625	14.65	14.75	15.00
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.												
Prime Western	7.05	7.05	7.05	7.05	7.05	7.05	7.05	.....	7.15	7.20	7.20	7.25
Brass Special	7.15	7.15	7.15	7.15	7.15	7.20	7.20	.....	7.25	7.30	7.30	7.35
Tin (f. o. b., N. Y.) c/lb. Duty Free.												
Straits	40.125	39.875	40.00	40.25	40.30	40.25	40.50	.....	41.375	41.00	41.50	42.375
Pig 99%	38.875	38.875	38.875	39.00	39.00	39.125	39.25	.....	40.25	40.00	40.375	41.25
Lead (f. o. b., St. L.) c/lb. Duty 2½c/lb.	8.15	8.15	8.20	8.15	8.15	8.15	8.15	.....	8.15	8.15	8.15	8.15
Aluminum c/lb. Duty 5c/lb.	23.50	23.50	23.50	23.50	23.50	23.50	23.50	.....	23.50	23.50	23.50	24.00
Nickel c/lb. Duty 3c/lb.												
Ingot—Internat. Nick. Co.	29	29	29	29	29	29	29	.....	29	29	29	29
Outside Spot	29	29	29	29	29	29	29	.....	29	29	29	29
Electrolytic (Internat. Nick. Co.)												
Ni.—99.80 contam. impur.—14	32	32	32	32	32	32	32	.....	32	32	32	32
Brit.-Amer. Nick. Corp.												
Ni.—98.50 contam. impur.—.80	29	29	29	29	29	29	29	.....	29	29	29	29
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	7.125	7.125	7.125	7.125	7.125	7.125	7.125	.....	7.125	7.125	7.125	7.125
Silver (foreign) c/oz. Duty Free	64.75	64.00	64.00	64.125	63.75	63.625	64.00	.....	64.00	63.875	63.875	63.875
Platinum $/oz. Duty Free	114	114	116	116	116	116	116	.....	116	116	114	114

Date	19	20	21	22	23	26	27	28	High	Low	Aver.	Mar. 2
Copper (f. o. b. Ref.) c/lb. Duty Free				Holiday								
Lake (Delivered)	16.00	16.25	16.25	.....	16.50	17.00	17.00	17.00	17.00	15.125	15.776	17.25
Electrolytic	15.875	16.00	16.00	.....	16.25	16.625	16.75	16.75	16.75	14.90	15.535	16.875
Casting	15.625	15.625	15.625	.....	16.00	16.375	16.375	16.375	16.375	14.50	15.145	16.50
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.												
Prime Western	7.30	7.30	7.35	.....	7.45	7.55	7.65	7.70	7.70	7.05	7.247	7.85
Brass Special	7.40	7.40	7.45	.....	7.55	7.70	7.80	7.80	7.80	7.15	7.358	8.00
Tin (f. o. b., N. Y.) c/lb. Duty Free.												
Straits	42.875	42.65	43.125	.....	44.625	44.25	44.875	46.625	46.625	39.875	42.031	46.25
Pig 99%	41.75	41.60	41.875	.....	43.50	43.50	43.375	45.50	45.50	38.875	40.859	45.00
Lead (f. o. b., St. L.) c/lb. Duty 2½c/lb.	8.15	8.15	8.15	.....	8.15	8.25	8.25	8.30	8.30	8.15	8.172	8.40
Aluminum c/lb. Duty 5c/lb.	24.00	24.00	25.50	.....	25.50	25.50	25.50	25.50	25.50	23.50	24.138	25.50
Nickel c/lb. Duty 3c/lb.												
Ingot—Internat. Nick. Co.	29	29	29	.....	29	29	29	29	29	29	29	29
Outside Spot	29	29	29	.....	29	29	29	29	29	29	29	29
Electrolytic (Internat. Nick. Co.)												
Ni.—99.80 contam. impur.—14	32	32	32	.....	32	32	32	32	32	32	32	32
Brit.-Amer. Nick. Corp.												
Ni.—98.50 contam. impur.—.80	29	29	29	.....	29	29	29	29	29	29	29	29
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	7.125	7.125	7.25	.....	7.25	7.375	7.375	7.75	7.75	7.125	7.201	8.25
Silver (foreign) c/oz. Duty Free	64.125	64.125	64.375	.....	64.875	65.375	66.00	66.375	66.375	63.625	64.396	66.00
Platinum $/oz. Duty Free	114	114	114	.....	110	110	110	110	116	110	113.888	110

Metal Prices, March 5, 1923

INGOT METALS AND ALLOYS

Brass Ingot, Yellow	"	"	"	11½to13
Brass Ingots, Red	"	"	"	14 to15½
Bronze Ingot	"	"	"	14½to16½
Bismuth				$2.85
Cadmium				$1.25
Casting Aluminum Alloys	"	"	"	21 to24
Cobalt—97% pure				$2.75-2.85
Manganese Bronze Castings	"	"	"	21 to33
Manganese Bronze Ingots	"	"	"	12 to16½
Manganese Bronze Forging	"	"	"	30 to40
Manganese Copper, 30%	"	"	"	28 to45
Magnesium Metal				$1.25-1.50
Parsons Manganese Bronze Ingots	"	"	"	19¾to21¼
Phosphor Bronze	"	"	"	24 to30
Phosphor Copper, guaranteed 15%	"	"	"	18 to23
Phosphor Copper, guaranteed 10%	"	"	"	17½to22½
Phosphor Tin, guarantee 5%	"	"	"	48 to58
Phosphor Tin, no guarantee	"	"	"	46 to56
Quicksilver				$70-71
Silicon Copper, 10%	according to quantity			28 to35

OLD METALS

Buying Prices		Selling Prices
13½to13¾	Heavy Cut Copper	14½to15
13¼to13½	Copper Wire	14¼to14¾
11¼to11½	Light Copper	12½to13
11 to11½	Heavy Machine Comp	13 to13½
8½to 9	Heavy Brass	10½to11
6¾to 7½	Light Brass	8½to 9
8½	No. 1 Yellow Brass Turnings	9 to 9½
10 to10½	No. 1 Comp Turnings	11¼to11¾
6¼to 6½	Heavy Lead	7 to 7¼
4½	Zinc Scrap	5 to 5¼
10 to10½	Scrap Aluminum, Turnings	12½to13
16 to16½	Scrap Aluminum, cast alloyed	18 to18½
17 to18	Scrap Aluminum, sheet (new)	19 to20
24	No. 1 Pewter	28
15	Old Nickel anodes	17
23 to25	Old Nickel	27 to29½

BRASS MATERIAL—MILL SHIPMENTS

In effect March 3, 1923

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.21⅛	$0.22⅞	$0.24¾
Wire	0.21⅝	0.23⅛	0.25¼
Rod	0.19¾	0.23⅝	0.25½
Brazed tubing	0.28⅞	.....	0.34¼
Open seam tubing	0.28⅞	.....	0.34¼
Angles and channels	0.31⅞	.....	0.37¼

To customers who buy less than 5,000 lbs. in one order

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.22⅛	$0.23⅞	$0.25¾
Wire	0.22⅝	0.24⅛	0.26¼
Rod	0.20⅜	0.24⅝	0.26½
Brazed tubing	0.29⅞	.....	0.35¼
Open seam tubing	0.29⅞	.....	0.35¼
Angles and channels	0.32⅞	.....	0.38¼

SEAMLESS TUBING

Brass, 25½c. to 26½c. per lb. base.
Copper, 27½c. to 28½c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	23½c. net base
Muntz or Yellow Metal Sheathing (14"x48")	21½c. net base
Muntz or Yellow Rectangular Sheets other than Sheathing	22½c. net base
Muntz or Yellow Metal Rod	19½c. net base

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	24¾c. to 25¾c.
From stock	25¾c. to 26¾c.

BARE COPPER WIRE—CARLOAD LOTS

19¼c. to 19½c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	23c. per lb. base
100 lbs. to 200 lbs. in one order	23½c. per lb. base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 9.65c. basis less 8 per cent. discount.

Casks, jobbers' prices	10¾c. to 11½c.
Open casks, jobbers' prices	11½c. to 12½c.

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga. and heavier, base price	36c.
Aluminum coils, 24 ga. and heavier, base price	33c.
Foreign	42c.

NICKEL SILVER (NICKELENE)

Base Prices

Grade "A" Nickel Silver Sheet Metal

10%	Quality	27¾c. per lb.
15%	"	29¼c. " "
18%	"	30¼c. " "

Nickel Silver Wire and Rod

10%	"	30¾c. " "
15%	"	34c. " "
18%	"	37c. " "

MONEL METAL

Shot	32
Blocks	32
Hot Rolled Rods (base)	40
Cold Drawn Rods (base)	46
Hot Rolled Sheets (base)	45

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 35 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25c. over. Above prices f. o. b. mill.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 69½c. to 72½c. per Troy ounce, depending upon quantity.

Rolled sterling silver 66½c. to 68½c.

NICKEL ANODES

85 to 87% purity	31½c.-34c. per lb.
90 to 92% purity	34c. -37c. per lb.
95 to 97% purity	36c. -39c. per lb.

Supply Prices, March 5, 1923

CHEMICALS

In Commercial Quantities—New York Prices

Acetone	lb.	.21½-.23
Acid—		
Boric (Boracic) Crystals	lb.	.12
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., Carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.08
Nitric, 36 deg. Carboys	lb.	.06
Nitric, 42 deg. Carboys	lb.	.07
Sulphuric, 66 deg. Carboys	lb.	.02
Alcohol—		
Butyl	lb.	.25-.30
Denatured in bbls.	gal.	.36-.43
Alum—		
Lump, Barrels	ib.	.04
Powdered, Barrels	lb.	.04½
Aluminum sulphate, commercial tech	lb.	.02½-.03
Aluminum chloride solution	lb.	.22
Ammonium—		
Sulphate, tech., Barrels	lb.	.03¾
Sulphocyanide	lb.	.65
Argols, white, see Cream of Tartar	lb.	.27
Arsenic, white, Kegs	lb.	.16
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Blue Vitriol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.06
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.07
Chrome Green	lb.	.36
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.37
Carbonate, Barrels	lb.	.19
Cyanide	lb.	.46
Sulphate, Barrels	lb.	.06½
Copperas (Iron Sulphate, bbl.)	lb.	.02
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	4.40
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	.26
Shellac	lb.	.82-1.00
Iron, Sulphate, see Copperas, bbl	lb.	.02
Lead Acetate (Sugar of Lead)	lb.	.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	1.15
Nickel—		
Carbonate Dry	lb.	.40
Chloride, 100 lb. lots	lb.	.27½-.40
Salts, single, bbls.	lb.	.12
Salts, double, bbl.	lb.	.11
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity		.35-.40
Potash, Caustic, Electrolytic 88-92% fused, drums	lb.	.07½
Potassium Bichromate, casks	lb.	.10½
Carbonate, 80-85%, casks	lb.	.06
Cyanide, 165 lb. cases, 94-96%	lb.	.65
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Official	oz.	—
Rosin, bbls.	lb.	.03½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.08
Silver Chloride, dry	oz.	.86
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.46
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—		
Biborate, see Borax (Powdered), bbls.	lb.	.06
Cyanide, 96 to 98%, 100 lbs.	lb.	.23
Hyposulphite, kegs	lb.	.04
Hyposulphite, kegs	lb.	.04
Nitrate, tech. bbls.	lb.	.03
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass) bbls.	lb.	.02
Sulpho Cyanide	lb.	.45
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.12-.13
Sulphur (Brimstone) bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.33½
Tripoli	lb.	.03
Verdigris, see Copper Acetate	lb.	.37
Water Glass, see Sodium Silicate, bbls.	lb.	.02½
Wax—		
Bees, white ref. bleached	lb.	.55
Yellow, No. 1	lb.	.35
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls.	lb.	.13-17
Chloride, 600 lb. lots	lb.	.07
Cyanide	lb.	.37
Sulphate, bbls.	lb.	.03¼

COTTON BUFFS

Open buffs, per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base,	42.95
14 inch, 20 ply, 64/68, cloth	base,	53.40
12 inch, 20 ply, 84/92, cloth	base,	49.85
14 inch, 20 ply, 84/92, cloth	base,	67.15
12 inch, 20 ply, 88/96, cloth	base,	55.95
14 inch, 20 ply, 88/96, cloth	base,	75.35
Sewed Buffs, per lb., bleached and unbleached	base,	.55

FELT WHEELS

		Price Per Lb. Less Than 100 Lbs.	300 Lbs. and Over
Diameter—10" to 16"	1" to 3"	2.75	2.50
" 6" 8" and over 16"	1" to 3"	2.85	2.60
" 6" to 24"	Over 3"	3.15	2.80
" 6" to 24"	½" to 1"	3.75	3.50
" 4" to 6"	¼" to 3"	4.75	Any quantity.
" Under 4"	¼" to 3"	5.35	

Grey Mexican or French Grey—10c. less per lb. than Spanish, above. Odd sizes, 50c. advance.